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Rochester, Nevada's Newest Boom Camp

By H. C. Cutler*

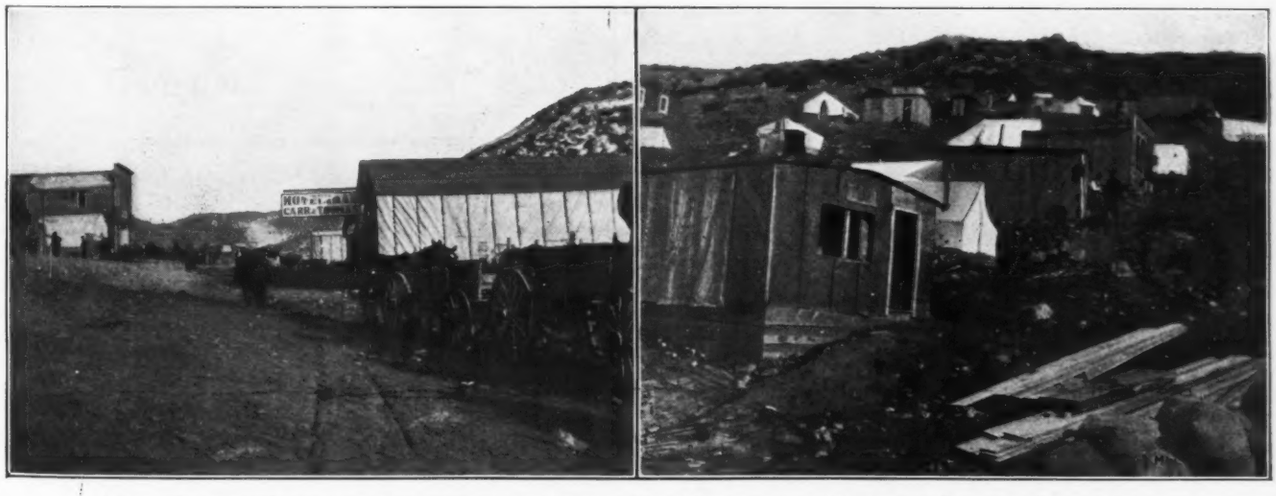
Rochester, the latest "boom" camp in Nevada, is situated in Rochester Cañon, Humboldt Range, about 25 miles northeast of Lovelocks and nine miles east of Oreana, the nearest railway station on the Southern Pacific. The average elevation of the various towns in the cañon is about 6200 ft., while Nenzel Peak, on which the main vein outcrops, is about 7000 ft. above sea level. The winter conditions are rather severe for Nevada and the snowfall is heavy.

Nenzel the Discoverer

Joe Nenzel, the so called "Father of the Camp," and the original discoverer, has owned his claims for several years and developed them in a desultory manner. During the summer of 1912 several sets of lessees worked on various parts of his ground, shipping ore practically from the grass roots. As near as can be ascertained the ore ran from $18 to $80 per ton, the principal value being in silver. This attracted the attention of a boom-camp newspaper man who, through clever articles in his paper

Outcrop of the Main Vein on Nenzel Peak. High-grade Ore Sacked for Shipment

View of Rochester Cañon from Nenzel Peak, Showing the Tents and Buildings of the Towns



The Lower Town of Rochester and Rochester Heights in Nevada's Latest Boom Camp

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and correspondence in others, finally started a boom or stampede to the new "diggings." It was the psychological moment.

The public was ready and waiting for a boom in Nevada. It started in November and at present the various towns in Rochester Cañon have a combined population of about 1500 people. Tents and frame buildings are springing up on all sides. People are coming in from all quarters. Strings of auto freight teams and auto trucks line the road from Oreana to camp. Saloons and dance halls are running full blast. The absence of the roulette tables and faro layouts is conspicuous, but other forms of gambling flourish. Rochester is a full-fledged boom camp, with all the attendant features.

Oreana, the railroad point, has developed from a sidetrack and section house to a town of such importance as to be a stop of the overland trains. A new hotel of sufficient capacity to accommodate 50 guests has just been completed and several stores, saloons and restaurants are open for business.

"Have we a second Tonopah?" is the question asked on all sides. The basis of the whole structure is the main vein on Nenzel Peak. This strikes in general northeast-southwest, dipping to the southeast. It outcrops for a distance of about 1500 ft., showing ore in a number of places. It is a strong vein from two to 20 ft. wide, of silicified rhyolite, carrying various compounds of silver and some gold. In places the assays run as high as $100 in one- to three-foot streaks.

A number of leases have been granted on the Crown Point claims, owned by the Nenzel interests, and lessees are developing vigorously. At present the greatest depth is over 25 ft., but tunnels have been started to cut the vein at depths varying from 60 to 180 ft. If pay ore is found at these depths the vein will be considered proven by the main promoters and the boom will receive a new impetus.

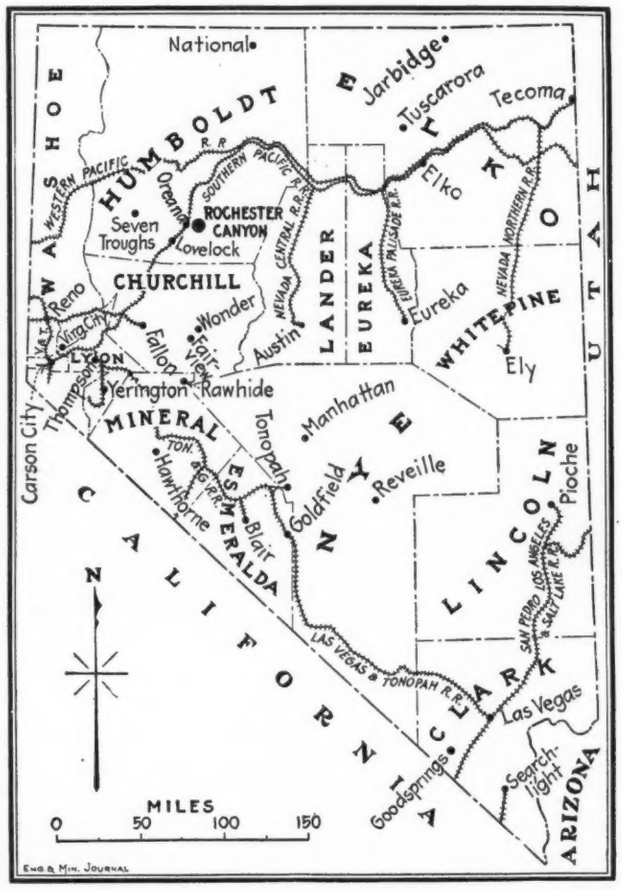
Deals involving thousands and millions of dollars are spoken of easily, but one of the important groups of the district adjoining the Nenzel ground on the north was recently acquired by the Wingfield interests for $12,500. A great number of companies are being floated on slight surface showings and great care should be exercised by the public in the purchase of such stocks.

The Humboldt Range has long been noted for its great production of precious metals. [Oreana, it may be mentioned in passing, was the site of the first silver-lead smelting plant in the United States—Editor.] American Cañon, just over the ridge from Nenzel Peak, is credited with $10,000,000 in placer gold. This is probably high. Various silver properties have produced millions, but these older mines had certain common characteristics. They occur in Triassic rocks, especially in the limestones of the middle Triassic. The ores, as a rule, were antimonial, containing much more silver than gold, with little lead and zinc.

Ore in Rhyolite and Other Eruptives

The vein at Rochester differs in that it is contained in eruptives known as the Koipato formation. This formation consists of volcanic flows, mostly rhyolitic, but including also andesitic lavas associated with tuff, conglomerates, grits and limestones. As Ransome says, it is a volcanic complex, of which nonvolcanic sediments, including limestones, form a subordinate part. The immediate country rock of the main vein is probably rhyolite, with some andesite of the Triassic age. The ores are the replaced and silicified country rock. There is much doubt as to whether the precious-metal content will be high enough to allow much ore to be shipped, but it seems fairly certain that a large milling property will be developed.

The next most favorable part of the district is Lincoln Hill, about a mile and a half farther down the cañon from Nenzel Peak. Several shipments of float and ore from grass roots were made from here and higher gold assays reported. A number of leases have been granted in this vicinity and development work is under way.



Map of Nevada, Showing Situation of Rochester

Across the ridge from Rochester Cañon, at the head of Limerick Gulch, is situated the Plainview group of claims. Here the vein at the surface is about 15 ft. wide and shows an oreshoot averaging $10 in gold and silver, with the gold predominating. The whole district is faulted to a marked extent and some difficulties in following the various veins will be encountered.

At present it is a waiting situation. Development work is under way in a great number of places, and the future of the camp is dependent on the results of this work. Meantime many wildcats are being promoted, and great care should be used in investing. The district covers an area of several square miles. Surface indications are good in a number of places, and I am satisfied several good mines will be developed. Weather conditions prohibit shipping at present, so that actual knowledge of the value of the ore cannot be had.

Relation of Outcrops to Ore at Cananea

By Morris J. Elsing*

SYNOPSIS—Knowledge of the relations between outcrops and developed orebodies is essential in directing exploration under other outcrops. There is a great variety of copper deposits at Cananea. The strength of the outcrop is small indication of the value of the deposit. Certain surface showings are favorable but geologists must be ready to recognize new types.

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One of the most important and interesting subjects to the economic geologist is the relation of outcrops to ore deposits. The surface indications are often the only evidence we have upon which we can base our plans for prospect and development work. Naturally, therefore, in recommending that a property be purchased or acquired or even in advising work in an already established mining district, we mentally compare this or that outcrop, gossan or surface showing and the results of the underground development with the same features of the one under consideration. It often becomes a matter of comparison. If one had all the details of the surface indication of copper deposits at his fingers' tips, other things being equal, he would attain in the recommendation of work for the discovery of new orebodies the greatest ratio of success to failure.

The object of the present paper is to contribute to the literature on outcrops a brief summary of the important types of ore deposits at Cananea and a description of the surface indication of their occurrence together with the relation that exists between the outcrop and orebody. In so far as possible, the genesis of these orebodies will not be discussed.

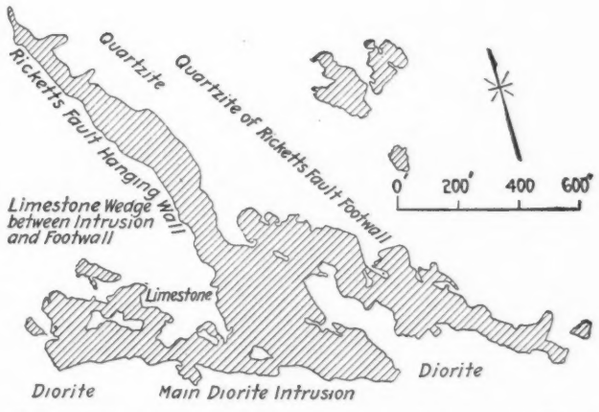

Fig. 1. Horizontal Projection of Oversight Stope.

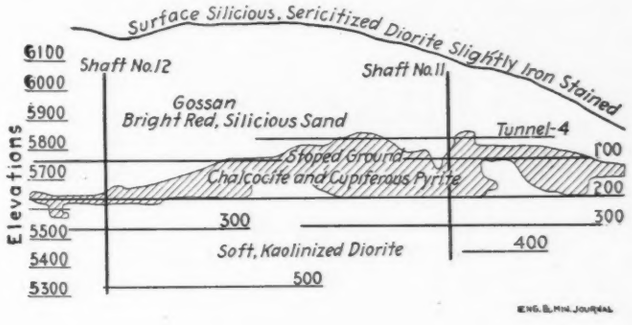

Fig. 2. Longitudinal Projection of Oversight Stope

Contrast in the Outcrops of the Oversight Shoots

The accompanying horizontal projection, Fig. 1, of the ore mined in the Oversight shows two oreshoots which join toward the southeastern end. The more northerly shoot occurs along the Ricketts fault, the foot wall of which is quartzite while the hanging wall is limestone. This fault zone has been the locus for ore-bearing dioritic intrusions in which, by the processes of secondary enrichment, commercial orebodies have been formed. The ore in the southwestern shoot occurs on the contact of the main diorite mass, from which the diorite along the Ricketts fault zone is a spur, and the same fault block of limestone which forms the hanging wall of the Ricketts fault. In both cases the most of the ore occurs in the diorite but some of it is occasionally found in the soft decomposed limestone near the contact. Practically all of the ore is secondary chalcocite occurring as grains, seams and irregular masses with some cupriferous pyrite in a much sericitized and kaolinized fine-grained diorite.

The outcrop of the southwestern shoot, which is on the contact of limestone and the main diorite mass, is a strong heavy iron gossan, about 300 ft. long and up to 30 or 40 ft. wide, composed of both massive and porous limonite and hematite with some silica. High-grade chalcocite ore occurred within 50 ft. of the surface. Underground, the gossan over the ore occurred as a siliceous iron dry bone.

The outcrop of the ore on the Ricketts fault zone is entirely different. Iron here is not the predominating feature. The outcrop is essentially a slightly porous siliceous sericitized diorite with iron only as a stain along seams and minor fractures. A small mass or two of quartzite marks the trace of the Ricketts fault and an occasional siliceous outcrop. The whole is inconspicuous and there is practically nothing to lead one to believe that underground along this zone for over 2200 ft. there is continuous ore. Directly over a large part of the ore in this shoot, there is a bright red siliceous sand which contains no carbonates. The accompanying section along the strike of this orebody, Fig. 2, shows that there is no relation between the thickness of the orebody and the depth below the surface. The thickness of the gossan varies from 150 ft. at the northwestern end to over 600 ft. at the southeastern end.

Sulphides Beneath Iron Cap in Capote Mine

The geology of the Capote mine is much complicated

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both from the fact that it is often impossible exactly to define and distinguish the different rock formations, and because the faulting and cross-faulting have been so complicated and intricate that these difficulties have been greatly increased. No attempt will be made to discuss this intricate geology in detail but only a generalization of the Capote occurrence will be described.

The bonanza orebody of the Capote mine, as shown in Fig. 3, was a massive bed of chalcocite ore lying in the great Capote fault zone. Metamorphosed limestone forms one wall of this orebody and quartzite the other, while between and closely associated with the ore there are intrusions of diorite. Below the 200 level, this bonanza orebody divides into two shoots, which have been followed down into quartzite in depth.

The ore in the eastern shoot is composed of numerous veins and seams of chalcocite in brecciated quartzite at the intersection of the Capote fault and a cross-fault. The ore in the western shoot is in a similarly brecciated zone but consists primarily of pyrite, bornite and chalcopyrite. It is much more irregular in form and has not been mined continuously from the 200 to the 700 level as was the case in the eastern shoot.

The outcrop of the Capote orebody is the strongest and most prominent in Cananea. It is a mass of almost solid iron, 300 ft. wide by 500 ft. long. In the early days, there was quarried from it for flux a large tonnage of iron ore that ran 50 to 60% Fe and 5 to 10% SiO_2. It is composed of both massive and porous material, and, in addition to limonite and hematite, it includes a large amount of magnetite, thus suggesting that in part the bonanza orebody may be due to a leaching of a high-grade contact metamorphic body, in which magnetite was one of the primary minerals. The thickness of this gossan over the highest part of the orebody was about 150 ft. Directly above the ore, the gossan was a fine, dry iron sand, which followed and ran through the smallest holes into the square-set stopes. No carbonates of copper can be seen in the gossan on the surface nor did they occur underground. The ore was nearly all massive chalcocite with varying amounts of pyrite. This bonanza was about 150 ft. thick and bottomed at about the 200 level, continuing in depth as to the two shoots described.

Large Cananea Duluth Orebody with Inconspicuous Outcrop

The Cananea Duluth orebody is a regular well defined deposit, 1200 ft. long by 200 ft. wide. It has a strike of N 40° W, and below the 400 level dips about 80° toward the west. These relations are shown in Fig. 5. The locus of deposition, as a whole, represents a dike of brecciated diorite-porphyry, intruded into a bedded tuff. Alteration has been extensive and it is impossible to distinguish between the individual fragments in this brecciated diorite. The silicified tuff closely resembles the fine-grained diorite, but it is possible to say that diorite, tuff and probably some acidic porphyry are present. Considerable faulting has taken place in the body itself, but probably it does not extend far into the tuff walls. Little prospect work has been done outside of the limits of the orebody itself. The tuff walls are easily distinguished and wherever they are cut show little mineralization.

The ore above the 200 level consists mainly of chalcocite. The body above this level is practically all ore for 200 ft. wide and 1200 ft. long. Below the 200 level, the commercial part of the body is found only on the periphery of this brecciated diorite dike, directly on the contact with the tuff. The ore here is different in character. Secondary chalcocite has given way to chalcopyrite and tetrahedrite; pyrite, some zinc and a little lead ore are also present. These minerals, along with quartz, occur in grains and veinlets and form the cementing material, in which are embedded the fragments of the breccia. Especially at both ends of the mine, where brecciation has been exceptionally great, quartz, tetrahedrite and chalcopyrite are often found as a lining in cavities and open spaces in the brecciated mass. It is here that the stopes are largest and richest. The interior of the entire brecciated mass is, as a rule, of lower grade than the perimeter, but above the 200 level secondary enrichment has been sufficiently great to constitute ore, while below the brecciation still exists and some mineralization, but no enrichment.

The stopes on the lower levels are from 10 to 30 ft. wide and always occur with the tuff wall sharply and well defined. The ore on the other side of the stope gradually fades out into the more or less barren breccia, a stope width of more than 30 ft. being seldom obtained.

The outcrop of the Cananea Duluth orebody is rather inconspicuous. It forms a narrow ridge trending northwest and southeast, of silicified brecciated diorite, which is somewhat more resistant to weathering than the surrounding tuff. That part of the outcrop that is not covered by wash is composed of altered fragments of diorite, usually bleached and sericitized, stained yellow and brown. The oxides of iron, except as stains, are almost entirely missing. No oxides of copper can be seen on the surface. Quartz veins and stringers seem to be characteristic of this outcrop. A gossan of this nature with an average thickness of about 125 ft., overlies the Duluth orebody. At this elevation the top of the chalcocite zone commences. This zone attains a thickness of about 100 ft., at which depth the primary ore, as already described, is reached.

Veta Grande Shows Siliceous Outcrops

Across Democrata Gulch from the Veta Grande mine, several tunnels have developed a large tonnage of low-grade chalcocite ore in a brecciated diorite. This ore occurs in both walls of a northwest fault zone, mainly as a secondary enrichment of cupriferous pyrite on the seams and fragments of the silicified brecciated diorite. The ore is irregular and has no definite boundary and occurs at a considerable distance from any contact. The surface over this orebody is steep and rugged. Several irregular siliceous outcrops have resisted erosion and stand out prominently. No indication as to the definite strike of the ore can be obtained from the surface, and, on the whole, the showing might not be considered epecially favorable. No oxidized ore can be seen on the surface nor is there any in the leached sericitized diorite over the ore.

Garnetiferous Cobre Grande Ore

The ore in the Cobre Grande occurs in a narrow northwest fracture zone in siliceous diorite. The ore in the upper portion is chiefly oxidized and includes cuprite, chalcotrichite and malachite. In the northwestern end of this narrow zone the ore is chiefly chalcocite in kaolin. Garnet is associated with a large part of the ore. It was apparently one of the constituents of the original

mineralization and can be found as vein material, accompanied by a small amount of sulphide, on many small fractures parallel to the Cobre Grande.

The outcrops of the Cobre Grande fracture in part were a narrow zone of decomposed garnet with copper carbonate between two siliceous walls of diorite.

Barren Pyritic Vein the Source of Eureka Mineralization

The deposits in the Eureka mine occur in a marbleized limestone that has a dip of 45° to a little east of north. At almost right angles to the strike of the limestone beds, there is a vein of pyrite which has a dip of about 35° to the southeast. At its northern end, this vein of pyrite gradually changes its strike until it finally assumes a strike that is parallel to the strike of the limestone beds but it still maintains its dip of 45° in the opposite direction to the dip of the limestone. By reference to the accompanying drawing, Fig. 4, this relation will be seen. This vein of pyrite varies in width from 6 to 18 in. and is practically barren of copper. The copper minerals, principally chalcopyrite and some bornite, occur parallel to this vein either in the hanging wall or foot wall or in both, or else the ore makes out along certain favorable beds of limestone, in many instances the original bedding of the limestone being preserved. In the case of the vein, both walls for a few feet are considerably altered and show some evidence of slight faulting parallel to the vein. In the case of both the vein and the beds, the limestone has been almost entirely replaced by pyrite, chalcopyrite and some zinc blende.

The following average analysis of the Eureka ore will show how complete this replacement has been: SiO_2, 15%; Al_2O_3, 4.5%; Fe, 26%; CaO, 5.5%; S, 28%. The composition of the limestone from a near-by quarry is as follows: SiO_2, 6.5%; Al_2O_3, 0.8%; Fe, 3.5%; CaO, 50%; S, 1.5%.

All the ore in the Eureka is directly associated with this or a similar pyrite vein. In some cases, beds have been mineralized to a distance of 150 ft. away from the vein but so far, in practically all cases, the ore can be traced back to this barren pyrite vein.

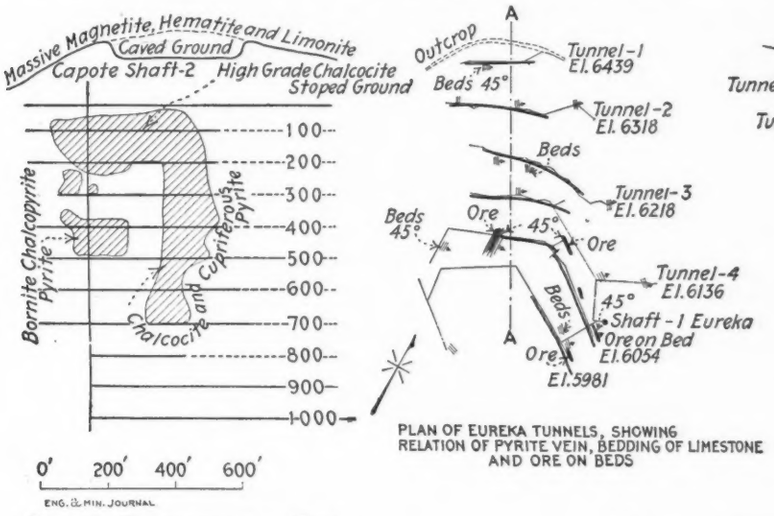


Fig. 3. Longitudinal Projection of Capote Mine

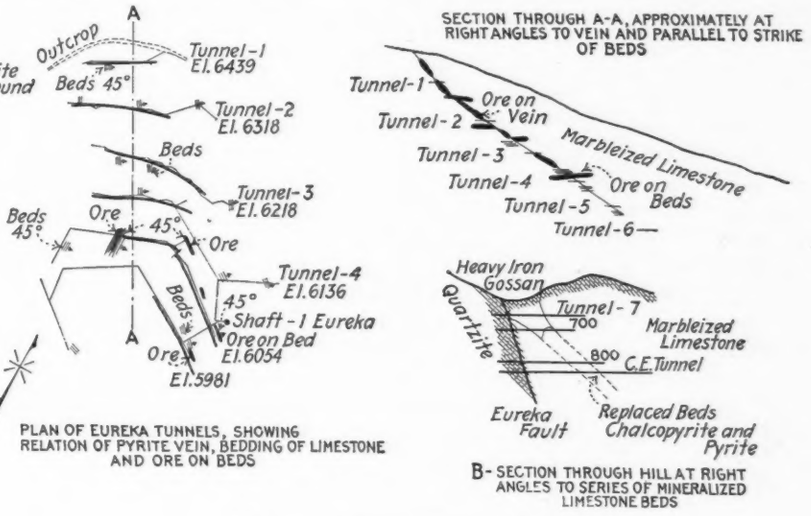


Fig. 4. Eureka Hill Deposits

The outcrops at the Eureka mine are of two kinds, namely the outcrop of the vein and the outcrop of a consecutive series of mineralized beds.

Outcrop of Eureka Vein Inconspicuous

The outcrop of the vein can be traced a distance of about 300 ft. For the greater part of this distance it is a mineralized zone from 5 to 10 ft. wide, containing oxides of iron and a few bunches of carbonate ore. It is rather inconspicuous and does not stand out above the surface except at the south end, where it terminates in an irregular iron outcrop near the Eureka fault at which point ore was mined to the surface. In tunnel 1, ore was mined within 20 to 30 ft. of the surface. The ore in this tunnel was mostly carbonate although it did contain a little sulphide on the tunnel level. It was probably of a little higher grade than the ore in the lower levels, due to a certain amount of enrichment and corresponding impoverishment of the vein material above. In Eureka Hill, there is a second vein similar in nearly all respects to the one described. The outcrop of this vein, however, was even smaller and less conspicuous than the first and its importance was for a long time overlooked. Upon development, at one place, a good sized stope of high-grade chalcocite ore was discovered. The gossan above this ore was a bright red siliceous dry bone, and although only 50 ft. below the surface it did not outcrop.

The outcrop of one of the series of mineralized beds is considerably more prominent than that of either vein. This gossan is about 100 ft. long and not less than 40 ft. wide. It consists principally of the oxide of iron, but there are no copper minerals present. The accompanying cross-section *B*, Fig. 4, at right angles to the dip of the beds, shows the relation of this gossan to the ore below. The top of the stope did not end in the same sort of material that is found on the surface, but in low-grade pyrite with evidence of oxidation in the soft decomposed limestone. The surface gossan is, in all probability, the outcrop of this ore, but it is probably in part a concentration of the products of oxidation at the surface. There was apparently no enrichment at the top of the orebody and no carbonate ore.

Elisa Orebody a Garnetiferous Contact Deposit

The Elisa ore deposits occur in a garnetized limestone zone along and parallel to a contact of diorite porphyry. The ore consists mainly of pyrite and primary chalcopyrite in stringers and in irregularly disseminated masses through an almost massive garnet gangue. In the upper levels the orebodies occur as almost vertical lenses parallel to the contact. In the lower levels, the commercial bodies are larger and more irregular in shape. All are characteristic of typical contact metamorphic ore deposits. The garnet zone has no absolutely definite limits. It nearly always commences at the diorite contact while its opposite edge either fades out into marbleized limestone containing some garnet or it ends abruptly on some small slip or minor fracture. It is possible, however, to outline roughly a zone of massive garnet, as shown in Fig. 6. The maximum width of this zone is 200 ft. from the contact and all of the ore bodies to date have been found within this zone.

The outcrops of the Elisa orebodies are essentially similar to their underground occurrence. Ore was mined to the surface along the contact and changed there only in that for a few feet below the surface a small amount of azurite and malachite, mixed with chalcopyrite, was present. At a depth of about 50 ft. below the surface, the oxidized ore gave way to the sulphide. Below this point very little oxide was found. The limestone at the surface was only slightly decomposed along the Elisa fault which is parallel to the contact. There is no leached zone above the ore and practically no zone of secondary enrichment.

The ore at the Henrietta mine occurs along the contact of diorite porphyry and quartz porphyry and in both of these formations. The ore consists of chalcopyrite and bornite with considerable silica and a little lime in the form of garnet. Occasionally on the surface a few small bunches of oxidized copper ore mark the contact of these rocks. The ore is probably primary and has no characteristic outcrop.

Geologic Criteria to Guide Development

The description of the mines, as given, is more or less characteristic of each type of ore deposit found in Cananea. The outcrops of some of the other mines differ slightly from those described but not sufficiently to make their description necessary.

By summarizing the statements of the outcrops of the typical occurrences of ore deposits, it is possible to obtain criteria which should be an aid in development of unexplored territory.

It would, therefore, seem advisable to explore beneath ferruginous, siliceous, kaolinitic and sericitic outcrops in general and especially when they occur as follows:

(1) Along northwest fractures between quartzite and limestone, either as siliceous sericitized diorite which is characteristic of the Oversight; or along similar fractures as heavy masses of iron, which is characteristic of the Capote mine.

(2) As brecciated zones of silicified sericitized diorite in tuff, which is characteristc of the Cananea Duluth.

(3) As irregular siliceous outcrops in the diorite, distant from any contact, which is characteristic of the concentrating ore in the Veta Grande tunnels.

(4) As narrow zones of alteration accompanied by garnet in silicified diorite, which is characteristic of the Cobre Grande.

(5) As long narrow ferruginous outcrops or large irregular ferruginous replacements of the limestone, both of which are characteristic of the Eureka type.

In addition to these favorable conditions we may add:

(6) Garnetized limestone zones along contacts of the diorite of the Elisa type.

(7) Zones of contact between quartz porphyry and diorite porphyry of the Henrietta type.

Most Conspicuous Cananea Outcrops Unproductive

The foregoing description has included only those outcrops which upon development have been productive of commercial orebodies. This discussion would, therefore, be incomplete without a word about outcrops which have been, to date at least, unproductive. It might be said that the most prominent and conspicuous outcrops in Cananea, even after a fair amount of exploration work, with the exception of the Capote, have thus far been barren of commercial ore.

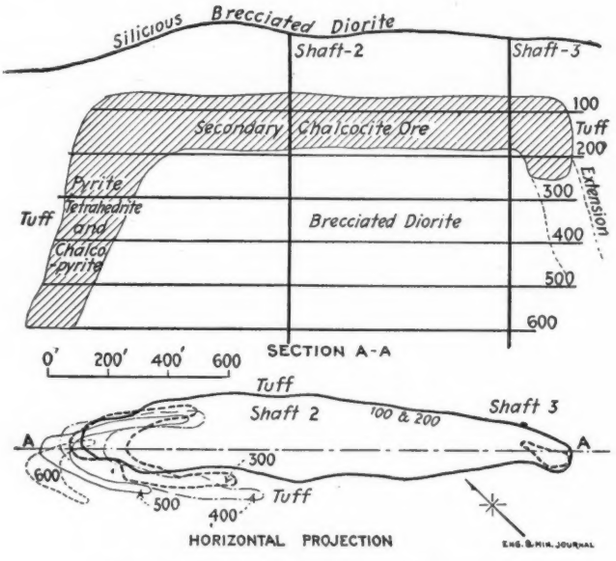


Fig. 5. Cananea-Duluth Orebody

The three most striking of these are in the heart of the camp between the largest and richest orebodies in Cananea and close to them.

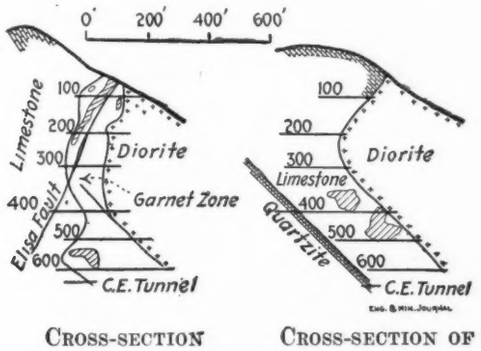
One of these is a large irregular siliceous iron gossan, roughly 200 ft. square, situated in the limestone about 1400 ft. from the Capote orebody and about 1200 ft. from the Eureka mine.

Another prominent gossan commences near the town of Chivatera and extends roughly south for over 1200 ft., with an average width of about 150 ft. The northern end of this outcrop consists of brecciated silica and iron. It has been quite resistant to weathering and stands out as blackened pinnacles and crags, forming a conspicuous landmark. To the south it is composed almost entirely of brecciated chert with siliceous cementing material. At its extreme southern end it terminates in the Veta Grande mine, where it contains sheets and flakes of native copper.

The third of these prominent outcrops is, in every way except one, the twin of the gossan over the great Capote mine. It is located on the Capote fault between

quartzite and limestone. It is fully as extensive but it probably did not stand out quite so prominently as that over the Capote, while its composition is approximately the same. Probably more than a quarter of a million tons of iron ore, running between 50 and 60% Fe, have been quarried from it. In the bottom in the center of this great quarry, there is a small core of low-grade sulphide ore. To date, all work below this quarry has shown up a soft decomposed limestone or unaltered quartzite.

It is quite possible that these enormous ferruginous and siliceous outcrops may be merely manifestations of mineralizing solutions, which were locally barren of copper. It seems, however, more reasonable to assume in want of decisive evidence to the contrary than in all probability these solutions were also copper bearing and that somewhere closely connected with these indications, there are likely to be orebodies. It often happens that directly associated with high-grade copper deposits, there are large masses of almost barren pyrite or large irregular masses of pyrite and silica. It therefore seems, when these surface indications are sufficiently large, that they should be so thoroughly prospected as to leave no reasonable doubt of their being unaccompanied by ore. For if a large mass of pyrite were encountered in prospecting, it would be most thoroughly blocked out so as to preclude any possibility of its being accompanied by ore and it seems as reasonable to prospect thoroughly the surface exposure of such mineralization even though in the oxidized state.



CROSS-SECTION EAST END — CROSS-SECTION OF WEST END

FIG. 6. ELISA OREBODY

GEOLOGIST SHOULD BE OPENMINDED

In the exploration of a productive copper-mining district, the geologist should not be bound down too closely by precedent. He should be prepared to find ore under quite inconspicuous and apparently unimportant outcrops. He should condemn no formation with the possible exception of recent sediments, conglomerates and lava flows, as barren, until they have been reasonably proved so. After considerable exploration, it is usually possible to prove that the source of the ore can be attributed to one or two igneous rocks. The greater part of the prospect work, but not all, should then be confined to these rocks or to the favorable sediments on their contacts.

Cananea, as a whole, is an excellent example of how almost every type of gossan has been the outcrop of a productive orebody. Geology, only in a very limited way, can say that this or that outcrop or gossan does not warrant some exploration. In the productive district, every outcrop, be it ferruginous or siliceous, is evidence of mineralization and therefore is of some value. It may be oftentimes possible for the geologist to form his opinion as to which is the more deserving outcrop, but seldom is it possible for him to predict with certainty whether this or that siliceous iron gossan is the outcrop of a commercial orebody or whether it is the outcrop of a mass of silica and pyrite.

In the productive district, is is seldom possible with safety to ignore any large extensive evidence of mineralization. In one case it may be similar to the outcrop of the known orebodies, which are distinctive of the camp and may be considered a favorable showing. In another case, such mineralization may be, up to the present time, unlike that which is indicative of the known commercal ore and therefore it might be considered unfavorable. In general, however, both of these showings should be prospected. In the former case, we should prospect in order to prove that ore does exist while in the latter it becomes necessary to do a certain amount of work to prove that ore does not exist and that we are not allowing a possible chance of finding ore to slip from us because of some preconceived idea as to the impossibility of its occurring according to any law except those that we have made.

SIZE OF OUTCROP NOT ONLY CRITERION

Perhaps the statements, that every outcrop be it ferruginous or siliceous is evidence of mineralization and therefore is of some value and if large enough warrants some work, should be enlarged upon. It is not meant by this that size should be the only criterion of its possibilities. Its location with respect to the favorable rocks or fault zones is far more important. If the camp has reached the stage where it has been possible to divide the formations of the districts into favorable and unfavorable, a small persistent showing in the favorable country would have infinitely more prospective value than a large showing in the so called unfavorable ground. The results at Cananea have proven that in the favorable formations, a very small outcrop has been the surface exposure of some of the richest ore in the camp.

In the camp where a profit is being won from the operations, it seems only fair that a certain amount of pioneer work should be done. An attempt should be made to extend the present accepted limits of ore deposition by doing a small amount of work in the most favorable parts of that district which heretofore may have been considered unfavorable. It may perhaps be in this that the only hope of extending the life and prosperity of the camp lies.

It seems to me that the most important work of the economic geologist is to determine what really is a gossan or favorable surface showing, which is the more favorable of several and, what is even more important, how to prospect it.

EXISTENCE OF TRUE GOSSAN MUST BE ASCERTAINED

Every surface exposure of iron does not represent a gossan. For example, a small outcrop of iron on a side hill in time may, by the processes of erosion, furnish enough iron float to cover the whole side hill presenting at first sight the appearance and evidence of great and extensive mineralization. Again, it sometimes happens

that a ferruginous conglomerate, at first sight, has almost every indication of actually being a gossan. I think I have seen several instances where iron has even been leached from one of these ferruginous conglomerates and penetrated and been deposited in the country rock below.

In some cases, it may even be necessary to do a small amount of surface work to determine whether what appears to be a gossan is actually one. It often becomes possible for the geologist to suggest a little preliminary work to determine whether more complete exploration should be undertaken. For example, a few bunches of oxidized copper ore may be unimportant if in the middle of some formation, but if by trenching we can say that they occur on the contact of two favorable formations, they immediately become valuable evidence and may warrant a considerable expenditure in exploration.

The question of elevation often becomes of tremendous importance in the prospecting for secondary ores. The relation of these ores to the surface contour of their outcrop and underground water level will often give evidence as to how and where to prospect.

The geologist, with all these details at his fingers' tips, should be able to plan the exploration work so that the most efficient prospecting can be done at the minimum expense, bearing in mind that it is oftentimes as valuable to know with reasonable certainty when to say. "Enough," as to know where and what to prospect.

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Zinc Mining in New York

By P. B. McDonald*

At Edwards, St. Lawrence Co., in the northern part of New York, a zinc mine is being developed, the only one in the state. Edwards is in the foothills of the Adirondacks in the St. Lawrence River drainage area and is 12 miles southeast of Gouverneur; the distance to New York by rail is 355 miles. A considerable orebody has been blocked out and a concentrator is being completed.

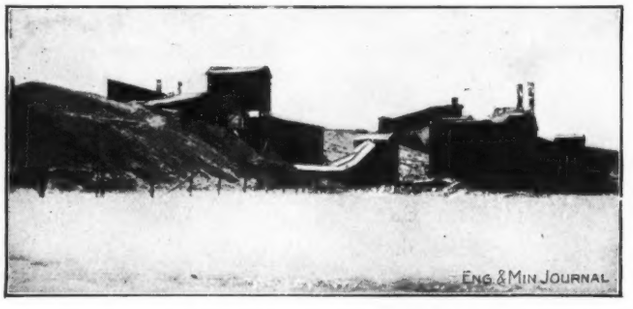
The orebody is a vein (bedded?) in limestone, which averages about 4 ft. in width and is nearly pure sphalerite with some pyrite. The Northern Ore Co. of New York is the operating company and is partially composed of the interests which operate the Benson magnetite mine and mill in the same county. F. J. Grugan is resident manager, succeeding A. J. Moore.

Prospecting by test-pits and shafts was carried on in 1904, starting from surface showings on the outskirts of the village of Edwards; a long period of legal difficulties was recently settled, and in April, 1911, operations were resumed. A shaft on the Brown farm has been put down 350 ft. in ore on an incline averaging 40°, and drifting has been done on 100-ft., 150-ft., 200-ft., 300-ft., and 350-ft. levels. The vein shown is irregular in strike and in width; the drifts (following the vein) make several curves; the width of the vein varies up to 10 ft., but is usually 4 or 5 ft. The ore is rich, as little galena or other lead ore is present. The foot wall is an impure coarsely crystalline limestone and is fairly regular; the hanging will is also limestone with some serpentine and is more irregular; barite is found in both walls.

About 200 yd. northeast of the Brown shaft, approximately in the line of strike of the vein, another shaft has been sunk on the White farm. Between the two shafts a hill interposes and it is not known definitely if the vein showing in the Brown is the same that shows in the White. The White shaft is down 120 ft. on a 45° incline in ore similar to that in the Brown workings, and a little drifting has been done on the 100-ft. level. Development is now in progress at both shafts.

The vein is probably a bedded vein, but the dip and strike of the limestone are indefinite, due to metamorphism and the numerous small quartzose stringers. These latter cut in all directions across the limestone and are probably the remains of a system of pegmatitic dikes. The limestone is classed as "Grenville limestone" of Pre-Cambrian age, and is a belt, 12 miles by two miles, inclosed in "Adirondack gneiss." Three miles northwest of the zinc mine are the famous fibrous talc mines at Talcville, which supply the bulk of the talc used in paper-making.

The zinc ore is remarkable for its richness and compact appearance. There is considerable pyrite in the upper levels but this varies irregularly and seems to decrease somewhat with depth. The sulphides extend to the surface and there is practically no oxidized zone. The blende is black, non-transparent and apparently carries considerable iron. The structure is not that characteristic of open fissure fillings, as there is no appearance of banding or drusy cavities lined with crystallized minerals.



Northern Ore Co.'s Zinc Mine, Edwards, N. Y.

The mill, built near the Brown shaft, is as yet in the experimental stage and no definite flow-sheet can be given; it was designed for 50 tons capacity of crude ore per day, and is expected to turn out concentrates containing 60% zinc. The pyrite will be saved as a separate product. Both mill and mine are at present operated by power from a steam power house, although electrical power can be purchased cheaply from water-power companies, if desirable later. Mines and quarries in the locality purchase power for about $30 per horsepower-year. Hoisting at the Brown shaft is done by a small electric hoist, the ordinary two-stage-geared machine which operates "like a trolley-car." Pumping is by compressed air; considerable water has been encountered, due to wet weather and to there being no other mines for three miles. The Gouverneur & Oswegatchie branch of the Rome, Watertown & Ogdensburg Ry. passes within a few hundreds yards of the mine.

*Mining engineer, Gouverneur, N. Y.

Sinking a Circular Shaft—II

By E. Mackay Heriot*

SYNOPSIS—Shaft sinking by the "petrification" process, the freezing method, the Kind-Chaudron and the sack-boring methods are here outlined, as well as the manner of erecting masonry or cast-iron shaft linings.

Shaft sinking by "direct cementing" or "petrification" process has been successfully carried out in Germany and France. It consists in finding water-bearing fissures that may interesect the shaft, and filling these with cement or concrete. The fissures are penetrated by borings. In France these holes are put down outside the shaft circumference and the whole ground cemented in one operation. The present practice in Germany is to do this in stages.

In the fissured sandstone of the coal measures of Upper Silesia, for example[1], considerable quantities of water are encountered even near the surface, and in depth much more. At the bottom of the shaft 16 holes were bored around the walls, and a pipe 2 m. long and 50 mm. inside diameter was placed in each, with 20 cm. of the upper portion exposed. The pipes were made fast with magnesia cement. In order to assure success, this work must be carefully carried out. A valve is fitted to the top of each pipe, by which it can be closed in case of boring into a water-bearing crevice. The valve also serves to close off the cement after it has been sufficiently pressed in, thus permitting it to set under pressure. Four Flottmann hammer drills were used to continue the holes to 10- or 12-m. depth.

The Petrification Process

The ordinary process consists in pressing a thin cement grouting into the holes. The higher the pressure the more the water is driven out of the fissure. The grouting was mixed in a receptable of 0.8 cu.m. capacity, tested at 15 atmospheres, situated at the bottom of the shaft. It was fitted with an agitator, pressure gage, joint flange with valve for the pressure pipes, joint flange with cock for the bore-hole pipes, and a test cock. A 5-hp. motor was used to work the agitator. The pressure pipes leading to the mixer connected at the surface with a compressor, which allowed 15 to 18 atmospheres. The apparatus proved a great success. In one hour every hole had been cemented. The pressure could be easily read off the gage. The cost of the whole installation was small. The holes cost only £1 10s. per m., and the total cost per meter for the cementing operation was £7. This process could be applied to many shafts and would save an enormous outlay in pumping plant and upkeep.

Waterproof Shaft Lining

Waterproof lining might advantageously be used in many places where it is not thought necessary, its principal application being to mineral deposits which carry no water, while the strata above them do. This is the case with salt and coal mines, and probably with many metal mines. One of the potash salt fields in Germany, as shown in Fig. 17, indicates clearly the conditions under which a waterproof lining is not only advisable but absolutely necessary.

In former days it was the custom in the coal region to sink a shaft to the coal measures and then to line it. In this way all the water encountered in the different strata was carried down to the bottom. Now, wherever water is encountered, it is shut out by masonry or cast-iron tubbing. That is, shaft sinking and lining are carried out in series, the length of each set of linings depending on the water horizons and suitable places for supporting walls or wedge cribs. Waterproof lining of any class should not be attempted without experienced foremen, because success depends on the carrying out of each detail in a proper manner.

Water-tight lining may be of masonry or cast iron. Masonry is not advisable below 70 m. depth, because at this depth the bricks become porous and act like a sponge. The limit of cast-iron tubbings seems to be at about 400 m. depth, when the thickness of the iron would have to be about 4.3 in. Riemer states that a thickness of 4 to 5 in. is the limit at which rings can be cast with reliability, or transported without abnormal difficulty.

A higher crushing resistance than 800 kg. per sq.cm. is not to be recommended, and there is no advantage in employing cast steel, since this material has no more resistance to compression than cast iron.

If ordinary tubbing is to be employed below 400 m. depth, the diameter of the shaft must be reduced, which is not always convenient. Riemer has patented a method to overcome this difficulty. Instead of reducing the diameter of the tubbing, the requisite thickness for a large diameter may be obtained by the use of two concentric tubbing cylinders, one within the other, the space between which is then filled with concrete.

Masonry Water-tight Lining

For the first few meters of depth, water from small fissures in the rock can be drained into the shaft by small lead pipes, but after this it must be done by well constructed iron pipes, fitted with valves.

At a suitable spot below the water-bearing stratum a supporting wall is placed, on which the lining is then built up. Great care must be taken to hold up any water that is entering the shaft from above, so that it may not disturb the masonry and wash off the cement. This is done by means of a launder, placed just below the water-bearing ground. From this launder a hose carries the water to the shaft bottom. Fig. 18, shows an extra shaft ring, which is found necessary in this operation.

This class of masonry requires more care than ordinary masonry. Masons should not be used except for placing the front row of bricks. For the rest of the work young miners are best. Masons are accustomed to use cement sparingly, and it seems to be impossible to make them do otherwise. In this class of work every joint must be filled. The bricks should be so pushed into place that the liquid cement flows up between the bricks. Care must be taken not to hammer on the wall, as masons often do, because this separates the mortar from the bricks and they do not bind again. Cement

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[1]"Glückauf," Aug. 12, 1911. "Neue Erfahrungen mit dem Cementier verfahren, etc."

must be used liberally and well mixed with the sand and water, so that when poured on the wall the bricks fairly swim in it. No binding joint between bricks should be more than 1 or 2 cm. The joint between masonry and rock should not exceed 2 cm., and if it does, this should be filled with broken pieces of brick. After any pauses, the top of the wall should be well scraped and brushed, and during the pause iron gutters should cover the wall to take off any water. Care must be taken not to separate the sand and cement, which is often done by working the mortar about on the wall, when immersed under water.

Ordinary cement sets in 24 hr. and hardens in one month. When working in the neighborhood of the water-bearing stratum, quick-setting cement is employed. This sets in about five hours and hardens in a fortnight.

Fig. 19 shows how the water is bricked out. Cast-iron pipes are laid against zinc plates, which rest against the rock. Great care must be taken that these pipes receive no shock, in which event the pipe would be separated from the cement and the water would afterward flow out underneath. In order to prevent the water from squirting over the masonry when bricking in the pipes, it is necessary to dam up the joints of the plates with bricks and cement; this will at once clear all water from the wall because it will then flow out of the pipes. After about one month the valves on the pipes are closed, and if the work has been well carried out the lining will prove to be water-tight.

Cast-iron Tubbing

There are two classes of tubbing, the English and the German. In the former, the segments are small and are supplied in a rough state, each joint having to be wedged with wood. The flanges are toward the outside of the shaft. Only those who have done it know the tedious operation of wedging joints. The German tubbing as a rule is 1.5 m. high, each ring consisting of some 10 segments. Between the two flanges, which are carefully machined and holed, there are two strengthening ribs. The segments are bolted together (Fig. 19a), lead sheeting being used as a packing. Great care must be taken to prevent any sand from falling on the lead, because this may throw the tubbing out of plumb or allow water to pass through. Each segment is bored, if necessary, with a weep hole, which is plugged with a piece of pitch pine well hammered in.

German Tubbing Widely Used

The German tubbing is now practically universal where cast iron is used as a lining. The tubbing is built up in series, each series being about 27 m. in height, and having a wedge crib (see Fig. 20) for its foundation. A wedge crib is a strong ring of cast iron also divided into 10 segments, packed and bolted in the same manner as the tubbing.

The placing of the wedge crib is no easy matter, and requires careful attention. If the ground be soft, it is sometimes necessary to place the crib on masonry; at other times two wedge cribs may be necessary, one on top of the other. First of all, the bed is made, the ground being evenly cut away. Water is allowed to rise, by which means it is seen whether the bed is exactly level. In bad ground the bed is made of concrete or masonry. In order to erect the wedge crib a fixed center is necessary, for which purpose a pile is driven in the center of the shaft. This pile is cut off at a level with the upper face of the wedge crib, and the exact center is marked with a nail. The sump is then covered with a platform.

Not many years ago it was customary to wedge in the crib, that is to say, fill in the whole space between wall and crib with pitch-line wedges. A work of this kind would take from three days to over a week. Now this space is filled with concrete. This system, described by me in the Journal of Dec. 29, 1906, consists in filling the space between the wedge crib, together with the first three rings, and the sides of the shaft with stamped concrete. The latter is stamped until water comes to the surface. The nature of the rock, whether hard or soft, has no influence on the result. It is absolutely essential that the walls of the shaft be quite dry up to five inches above the crib. Launders, as already described, are put in.

Concrete Filling behind Crib

The concrete behind the wedge may consist of one part of cement and two parts of sand. It is placed in layers 10 cm. deep and then stamped. The mixture should not be too dry nor too wet. If the sides of the shaft are so dry as not to give off sufficient dampness, the concrete must be moistened. Higher up, the concrete can be stamped in layers of 30 cm. For the first four rings the mixture is five parts of gravel, two of sand and one of cement. Where any water-bearing fissures are encountered, broken pieces of brick should be used in place of concrete, thus making channels leading to the weep holes.

The space between a section of tubbings and the wedge crib above it must be wedged with pitch pine. This operation is carried out with flat, square and round wedges, in the order named. When the space is fairly well filled, a steel "needle" is used. This is hammered into the wedges, thus making a hole for another wedge. This operation is continued, until the needle can no longer be driven in. The weep holes emitting water can now be plugged up; the other ones were plugged bfore.

For the work above described, the foreman of each shift, as well as his head man should be expert at the business. One of the other men should be a good, practical miner and have a good assistant; no other skilled labor is necessary.

In the foregoing I have only described the sinking of shafts by hand. I come now to shaft sinking in more complicated cases, such as in quicksand or through enormous quantities of water.

Riemer classifies the shaft sinking in difficult cases into three headings, namely: Shaft sinking by boring; by freezing the strata; and by the drum method. In describing these methods, mention must be made of such names as Pötsch, who, in 1883, introduced the shaft-freezing process; Chaudron, who in conjunction with Kind, formed the company for sinking shafts by boring; Riemer, the head engineer of the firm of Haniel & Lueg, who has done so much in the great success achieved by the boring method.

I only propose here to describe briefly the different processes in order that those who propose to carry them out may know under what conditions they should be applied, and have a general idea of the same. Let it be

said that the boring and freezing process should not be attempted by mine operators, but entrusted to specialists who contract for such work.

Kind-Chaudron Method

To insure success by this as well as by any other boring method, it is necessary to give the shaft a sufficient diameter and equip it in such manner that it will be suitable for boring. That is to say, the headframe should be constructed in such a manner that it can remain as a boring frame. No girders or timbering should be permanently placed in the shaft. Everything should be arranged in such manner as to allow clearing the shaft of all impediments at the shortest notice in case of a sudden inburst of water.

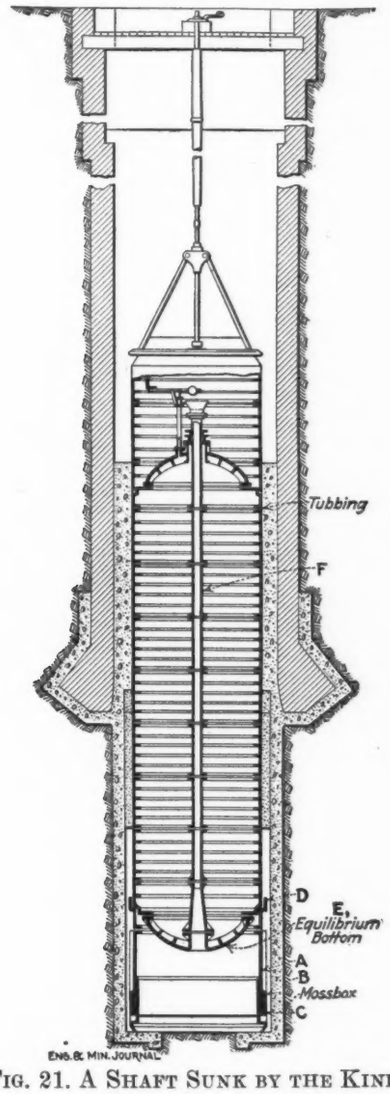


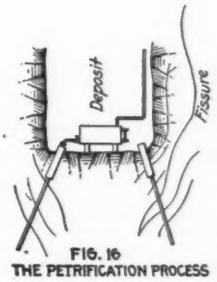
Fig. 21. A Shaft Sunk by the Kind-Chaudron Method (after Reimer)

The Kind-Chaudron method is applicable in rock containing any amount of water, the only requisite being a strong and impervious stratum above the mineral bed. For example, at the Adolf von Hausemann coal-mine shaft, as much as 4800 gal. of water per min. were encountered at about 200 m. depth. This shaft was successfully bored. At the Friedrichshall potash mines, the water at 100 m. depth was estimated at 8900 gal. per min. Pumps were installed with a capacity of 748 gal. per min., without avail. The shaft was bored and the water shut out.

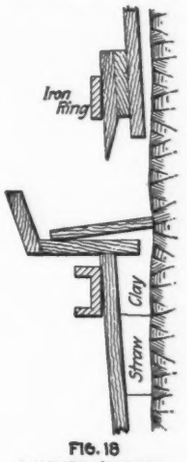
Riemer gives an account of 79 shafts sunk by the Kind-Chaudron method, most of which were in Germany and France, but none in America.

The process consists of boring shafts under water and then sinking water-tight linings, the most interesting part of which is the so called "moss box," which makes the bottom portion of the lining impermeable to water. The work is begun with a small borer, which weighs about 10 tons. The large borer is about 20 tons. Both are made of steel and are worked alternately. The cuttings made by the large one fall into the hole made by the small borer, thus keeping its cutting surface clean. The work is continued down to an impermeable stratum, under which no water is expected.

For the lining, cast-iron tubbings are used. In deep shafts this may weigh up to 4000 tons and would seem impossible to lower into a shaft, but this difficulty is overcome by making the iron work swim by the use of a false bottom. (See Fig. 21.)

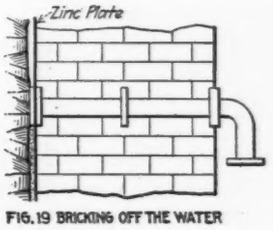


F16. 16
THE PETRIFICATION PROCESS

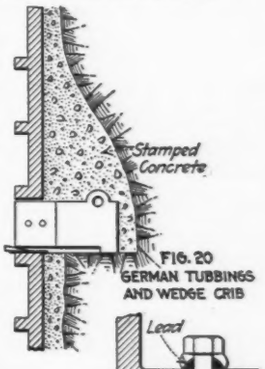


F16. 18
A WAY TO KEEP THE SHAFT SIDES DRY

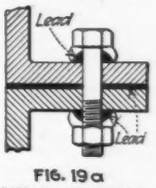
F16. 17
GEOLOGIC COLUMN IN GERMAN POTASH FIELD WHERE WATERTIGHT LINING IS NECESSARY



F16. 19 BRICKING OFF THE WATER



F16. 20
GERMAN TUBBINGS AND WEDGE CRIB



F16. 19a
METHOD OF BOLTING THE TUBBING

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The two rings which form the bottom part of the lining, the so called moss box, are placed in position, packed with moss and lowered into the shaft. When on a level with the landing stage a false bottom is placed over these rings. The tubbings are now built on and lowered bit by bit; the bottom end soon reaches the water and this takes off the weight. The buoyancy can be regulated by letting water in or out.

The two rings of the moss box are telescopic, the one entering the other. Between the two, moss is packed and bound with a net to keep it in place. When the moss box arrives at the shaft bottom, the weight of the

lining above it presses the one ring into the other, forcing the moss outward against the rock walls, thus making the lining water-tight.

Fig. 21 shows a moss box. *A* and *B* are two rings, capable of being telescoped into one another; *C* is the moss packing; *D* is the ring of the "equilibrium" bottom, *E; F* is the piping for letting in water to balance the lining. The space between the tubbing and the rock is filled with concrete, lowered into place in thin, self-dumping boxes.

The Yessenitz shaft took about 16 years to sink, and was finally completed by the boring system. The small borer was 2.44 m., and the large one 3.96 m. in diameter. The shaft was bored 30 m. in five months. Yessenitz shaft proves that water can be shut off in rock salt with certainty.

The sinking at Friedrichshall, already referred to, cost £17,132 for the 25 m. from 95.5 to 119.35 m. depth. Subtracting £2132 from sale of the plant, left a net cost of £15,000. Here must be taken into consideration the high cost of plant for such a short depth to be bored. The average cost per meter is likely to be between £300 and £500, which includes half the cost of surface apparatus. If the work is done by contractors they can use some of their plant again.

As regards time, the actual boring with the small tool may be taken as 12 m. per month, and with the large one at 5.5 m. All together about 3.5 m. per month. The firm of Haniel & Lueg bored the Sarstedt (Sollstedt ? ED.) potash-mine shaft from 36 to 150 m. inside of one year, an average of 19 m. per month.

THE FREEZING PROCESS

The principle of the Pötsch process is to bore holes about 1 m. apart through the water-bearing stratum at a certain distance from the circumference of the shaft. These holes are continued into waterproof ground. Inside the casing of each hole a second pipe is placed, open at the bottom. A cold solution is then circulated, which rises between the two pipes and absorbs heat from the surrounding quicksand. The freezing solutions are maintained at a temperature of about zero Fahrenheit by a refrigerating machine at the surface.

When the ground is sufficiently frozen, the shaft can be sunk by hand. A thickness of 2 to 4 m. is allowed for the frozen sides of the shafts.

LIMITATIONS OF THE FREEZING PROCESS

Riemer says that the depth to which the process can be employed has a limit which is fixed by physical conditions; the limit varies according to circumstances and cannot be easily determined. Heise-Herbst maintains that the process has the advantage of being applicable for both loose and fast water-bearing ground. However, they do not consider it favorable for warm or for strongly saline waters, or where there are underground currents either natural or artificial. Special praise for the perfecting of this method must be given to Gebhardt & Koenig, of Nordhausen, and Haniel & Lueg, of Düsseldorf. The cost per linear meter of shaft may be taken at from £210 to £500 and the monthly advance at eight meters.

The freezing process has been chiefly applied in France and Germany. It was once used in America at the Chapin mine, at Iron Mountain, Mich., the first 30 m. of ground being frozen and sunk through. A shaft of 300 m. depth has been put down by the freezing method at the Borth Solvay works, and other deeper ones are in process of sinking. The bore holes for freezing these great depths are kept vertical by the aid of the Ertinghausen deflection meter, improved by Gebhardt.

SPEED AND COSTS BY THE FREEZING PROCESS

The No. 1 Solvay shaft was completed to 300 m. depth in 36 months. This gives an average of over 8 m. per month. Some of the shafts lately sunk by the freezing method in Holland are worthy of special mention. The maximum advance made in one month, sinking in frozen ground, was as high as 83.54 m., and in lining 95.65 m. The monthly average, which counts from start of boring to finished shaft, 12.79 m. No doubt this is the record in any sinking done by the freezing process.

Professor Stegemann[2] has made an important study of the uptodate application of the freezing system. He takes as his "normal" (*Einheit*) type of strata the Tertiary formation of the Niederrhein basin, which consists of alternating layers of sand, clayey sand and clays, which he says present no difficulty to the freezing.

As in the "sinking-drum" shafts, so also the "freezing shafts" have so called "advance" shafts sunk to the water level. These are used as depositories and circulators of the fluids, and must have sufficient diameter to allow space for the freezing holes and the necessary extra holes, which are put down from the pit bottom. The cost of these shafts will not be included in the total costs, but they should be noted, as the whole success of the freezing operation may depend on this work's being well carried out. It is, in some cases, advisable to use reinforced concrete as a lining. In a large shaft of 6 m. diameter, which has to be sunk by the freezing process to 400 m. depth, 54 bore holes have to be put down. Each hole must be 410 m. long, therefore the total distance bored is 22,140 m. Boring the holes simultaneously should take 12 months. Three months would elapse between the beginning of freezing and the beginning of sinking, and the sinking and lining would be concluded in another six months. Eight months are then necessary to thaw the ice, the total operation thus extending over a period of 35 months. This is at the average rate of 11.7 m. per month of finished shaft. If this shaft had been only 4½ m. in diameter and sunk to 100 m. depth, only 25 bore holes would have been necessary, the total operation lasting eight months, with an average of 12.2 m. per month. The costs are taken as follows:

Depth	Diameter	Cost per Meter
100 m.	4.5 m.	£150
200 m.	5.0 m.	200
300 m.	5.5 m.	285
400 m.	6.0 m.	375

These costs are estimated for a two-shaft plant. For a single shaft it will come somewhat higher. The costs of the first and the last are as 9:22.5, but it must be remembered that the difference is not so large when one compares the useful cross-section, which is as 9:16. The price of 1 m. of lining for the above sizes of shaft and depth is from £50 to £200. This includes bolts, packing, concrete, etc. The concrete is taken as a mixture of one part cement, two of sand and three of pebbles.

[2]"Glückauf," Mar. 18, 1912: "Leistungen und Kosten beim Schachtabteufen nach dem Gefrierverfahren"; von Prof. Stegemann, Aachen.

The result is that the cost for a shaft of, say, 4.5 m. diameter and 100 m. depth, is divided as follows: Sinking installation, 9.82%; bore holes, 27.58; freezing installation, 7.29; freezing, 6.97; sinking and lining, 48.34. All these figures are, as already stated, estimated by Professor Stegemann for his normal type of formation. In the potash-salt mines the covering strata are much more difficult to bore on account of "falling in," and the large quantity of water necessitates much larger freezing installations. Thus here the price per meter will be higher.

The Sinking-drum Process

The sinking-drum process can be applied only where the ground is not hard and where there are no obstructions. For depths of over 25 or 50 m. it should not be used. The greatest depth attained, that I know of, was 178 m. The plant consists of a crib or sinking drum, held continually under pressure by a large number of hydraulic presses.

As a rule these shafts get out of plumb. This happens to iron tubbing as well as masonry. Cleavages in the lining are apt to take place. The shaft Hugo I was completely destroyed, although the iron was 70 mm. thick. The reason for such an accident is likely to be found in the fact that when difficulties occur in sinking, the shaft bottom is cut deeper and the neighboring ground is permitted to fall in, thus forming empty spaces around the shaft. At an unexpected moment a fall of ground is apt to occur, which may be heavy enough to break the lining. As in such cases the caving takes place under water, nothing is heard, but the sudden rising of the water level is observed.

In all kinds of shaft sinking great care should be taken to fill in behind the linings, and this can always be successfully done except in the case of the sinking-drum process. The miner cannot control the weight of material extracted in relation to the size of the excavation.

The danger will be appreciated from considering the following rough calculation by Riemer: Taking the breadth of the caving as being 4 m., the height of the water-filled space as 10 m., the length of the caving as one-quarter of the shaft circumference, or, say, 6 m., and the thickness of the caving mass as 5 m., about 8000 hp. would be developed.

The Sack Borer

The sack borer has been successfully applied in Europe to the sinking of many shafts through soft and watery materials. It is used in connection with sinking linings or drop shafts. The mechanism consists essentially of an auger, the stem of which is rotated at the surface. Each cutting blade is composed of a sharp-edged loop, to the back side of which is attached a sack made of canvas or woven rope. The rotation of the borer scrapes material from the bottom of the shaft, which, being caught in the sacks can then be hoisted to the surface and emptied. In the earlier forms it was necessary to lift and disconnect the auger stem (like a diamond-drill rod) to empty each sack-full, but the method was so improved by Sassenberg and Clermont as to allow the sacks to be hoisted while the stem remains in position. The use of pumps, especially the Mammoth pump, to lift the dirt excavated by the borer, has found increased application. The disadvantage of the sinking drum lies in the fact that it easily gets out of plumb. Like all rotating borers, the sack borer has a tendency to leave the perpendicular. The drums are made of cast iron.

The underground operation is begun by erecting the drum at the shaft bottom. On this the walling or tubbing is built up. As soon as the lining has reached the surface, excavation is begun. In the sinking of shaft No. 5, of the Rheinpreussen colliery, four drums of the following diameters were used: No. 1, 8900 mm. inside diameter; No. 2, 7850 mm.; No. 3, 5800 mm.; No. 4, 4620 mm. With the first drum a depth of 20 m. was reached; with the second, 74.5 m.; with the third, 96 m.; and with the last, 155 m. The Pattberg percussion borer was used, operating at sixty 10-in. strokes per min. The débris was loosened by water under pressure, and the dirty water was drawn up by an air-lift pump. As much as five meters were sunk in 24 hours.

Mt. Lyell Mining & Railway Co.

The Mt. Lyell Mining & Ry. Co. reports, for the half-year ended Sept. 30, 1912, a production of 3161 long tons of blister copper, assaying: Cu, 98.82%; Ag, 67.47 oz.; Au, 1.365 oz. The profits were £106,749, and dividends of £75,000 were paid.

From the Mt. Lyell mine, 96,247 tons of ore were extracted, and reserves (not including the South Mt. Lyell orebody) then stood at 2,361,182 tons, carrying: Cu, 0.532%; Ag, 1.96 oz.; Au, 0.027 oz. The ore extracted from the North Mt. Lyell mine was 58,913 tons, and the reserves were increased by 60,390 tons, standing at 1,083,752 tons, at Sept. 30, 1912, carrying: Cu, 6%; Ag, 1.33 oz.; Au, 0.005 oz. From the Chester mine 6748 tons of pyrites were extracted for the Yarraville and Port Adelaide Chemical Works. The Mt. Lyell Comstock Copper Co.'s property was purchased, toward which the Mt. Lyell orebodies seem to trend.

The reduction plant smelted 157,167 tons of company ore, 46 tons of purchased ore, 83 tons of metal-bearing flux, and 8894 tons of returns, producing 7545 tons of 45.95% matte, from which 3161 tons of blister were recovered.

The fire at the North Mt. Lyell mine occurred on Oct. 12, 1912, after the period covered by this report.

Mineral Production of India for 1911

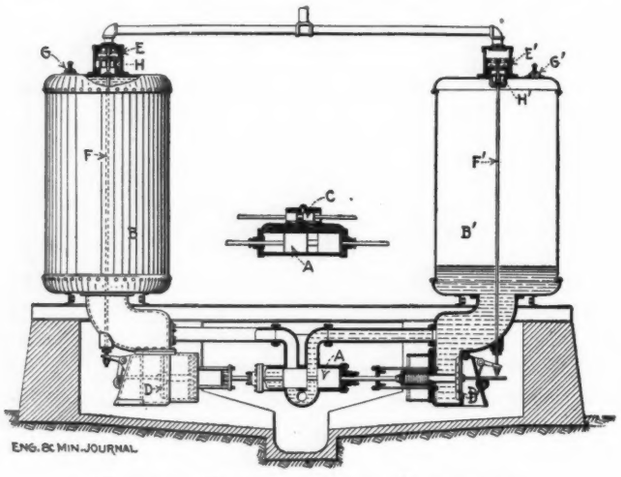
The mineral production of British India for 1911 is officially reported as follows: Coal, 12,715,534 tons; gold, 583,567 oz.; petroleum, 225,792,094 gal.; manganese ore, 670,290 tons; salt, 1,472,068; saltpetre, 14,674 tons; mica, 33,896 cwt.; lead ore and old slag, 35,361 tons; tin and tungsten ore, 1946 cwt., besides 1764 cwt. of block tin not contained in the above; ruby, sapphire and spinel, 288,213 carats; iron ore, 366,180 tons; jadestone, 2063 cwt.; silver, 103,849 oz.; graphite, 4048 tons; chromite, 3804 tons. The above items follow each other in order of descending value. Other minerals and ores produced, alum, garnet, corundum, magnesite, diamonds, amber, etc., collectively amount to only £8792. The total value of the mineral output is estimated at £7,657,261, a decrease of £41,678 from 1911.

Warren Hydraulic Air Compressor

The apparatus devised by G. D. Warren, of 1757 Blake St., Denver, Colo., should be useful around mines or other places requiring compressed air, where there is ample water power available; about 120 lb. water pressure is needed in this apparatus for an air pressure of 100 lb. The amount of water used is a little more than the amount of free air delivered.

Under these conditions of water supply, the plant could be installed much more cheaply than its equivalent of a waterwheel and belt-driven compressor. Furthermore the extreme simplicity of the apparatus is a great recommendation. It does not seem to be sufficiently developed yet to determine its relative efficiency as compared with the waterwheel and belt compressor; but even with a difference of 15 or 20% against it, its extreme simplicity and low cost will recommend it.

Referring to the accompanying illustration, water is admitted under pressure through valve *A*, situated between the compression chambers *BB*. This valve is worked back and forth in its cylinder by admitting water under pressure to one end through auxiliary valve *C*,



WARREN HYDRAULIC AIR COMPRESSOR

while the opposite end of the valve cylinder is exhausting to the atmosphere through *C*. This forces *A* to the exhaust end of its cylinder, shutting off admission to one tank just filled, and admitting water to the other tank that has been emptied, while at the same time it opens the large discharge valve *D* to the full tank, closing the corresponding valve communicating with the tank being filled.

These discharge valves are connected by a thick rod to the end of valve *A*, with stuffing boxes for their passage through the cylinder head of *A*. It will be noted in the illustration that water has filled tank *B* at the left and has raised the operating piston *E* at the top, which raises rod *F*, working the bell crank outward, thus pulling the connection attached to valve *C* and shifting *C* to the left, introducing pressure to the left end of the operating valve *A*, and opening the right end of *A* to the atmosphere. This valve *A* has been thrown to the right, which will admit water to tank *B'*, closing exhaust valve *D'* at *B'*, and opening the discharge valve *D* at *B*, thus filling *B'* with water and displacing the air contained up through the check valve located in the lower end of operating piston *E'*.

In the meantime tank *B* is emptying through *D* and taking air through the check valve *G* at the top. There is a hollow float valve, *H'* working loosely on the lower end of the check valve carried by *E'*, so when all the air has been discharged from the tank and the water reaches *H'*, it is carried by the water up to its seat in *E'*, where it is held, stopping further passage up to *E'*, which will be raised from its seat and carried upward in its cylinder to positions shown in *D*, *E* and *H*, thus raising rod *F'* which shifts bell crank connecting auxiliary valve *C*, after which the functions of the chambers will be reversed.

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Potash in Columbus Marsh, Nevada

Encouraging results have been obtained, according to a recent press bulletin by the U. S. Geological Survey in its potash explorations at Columbus Marsh, near the Esmeralda-Mineral County line, in Nevada. The railroad station for the marsh is Coaldale, on the Tonopah & Goldfield R.R. Columbus Marsh is a broad mud plain with a rough, lumpy surface. Little salt shows on the mud except about the margins of the plain, where some borax-producing plants were located in the earlier days of the borax industry. A small area about the margin of the marsh was located for borax a good many years ago, and a part has been patented. Columbus Marsh itself comprises an area of about 35 or 40 square miles, roughly elliptical in outline, being about nine miles in longest dimension from north to south and six miles or more in width. Shore terraces at heights of 70 to 75 ft. above the flat testify to the presence in this basin of a prehistoric lake of at least that depth.

Drillings here show, in one 38-ft. hole, from 2.01 to 25.18% of K_2O in the water-soluble portion of the cores, according to depth, the average amount of water-soluble salts in the core being 5.96%. The material at the bottom of the hole is nearly the richest in K_2O, and it is not known how much deeper the mud extends. The richest material was found at 27 ft. depth. Such assays of potassium in natural saline deposits of considerable mass of the desert-basin area are believed to be unprecedented. The indicated tendency to segregations of potash in such natural saline deposits is the basis of much of the experimental work of the Geological Survey in the search for potash in the desert-basin region.

On Jan. 16, 1913, the President withdrew from location and entry all the lands in Columbus Marsh that are supposed likely to contain valuable potash deposits, under authority of the withdrawal act as amended on Aug. 24, 1912. This amendment makes it effective as against all forms of entry under the mining laws of the United States except them that apply to metalliferous minerals. The withdrawal will enable the government to proceed in due course to make further examinations of these promising deposits.

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Fibrous Talc is mainly used in the paper trade as filler for book and writing paper, and to a considerable extent for newspaper. It is more readily incorporated with the paper stock than clay, and at the same time has a beneficial influence upon the strength of the paper, according to Bull. 161 on the mining and quarry industry in New York. The manufacturers of gypsum wall plasters are consumers of the talc, which takes the place of hair, wood fiber or asbestos in these plasters. Among the minor uses are in the manufacture of waterproof paints and steam-pipe coverings.

Present Status of the Thiogen Process

By S. W. Young*

SYNOPSIS—Experiments, conducted at the Penn smeltery, Campo Seco, Calif., have eliminated many of the early difficulties encountered in the practical application of the thiogen process, the theory of which involves the production of elemental sulphur by reducing smelter fumes by hydrocarbon vapor and a catalytic mixture of calcium sulphite and calcium sulphide. The chief chemical difficulty has been the poisoning of the contact mass; exit gases, containing practically no sulphur dioxide, have been maintained during 10- and 12-day runs.

The thiogen process for the elimination of sulphur dioxide from smeltery fume depends upon the reduction of the sulphur dioxide to metallic sulphur. At the outset it may be remarked that no purely catalytic process will ever be able to bring about this conversion. A definite quantity of chemical energy in the form of some reducing agent is absolutely necessary. The cheapest known reducing agent is fuel oil, and is hence used in the thiogen process. When sulphur dioxide and a hydrocarbon of the ethylene series, the formula of which, in its simplest terms, may be represented by CH_2, are heated together, the reaction which takes place is approximately $3\,SO_2 + 2\,CH_2 = 3\,S + 2\,CO_2 + H_2O$.

Catalysis as well as Reducing Agent Used

This reaction is, however, slow and incomplete, and in order to obtain satisfactory results it is necessary to use some reagent as an intermediary. Such a reagent has been found in calcium sulphide. The sulphide of any sufficiently basic metal would do equally well from the chemical point of view; but calcium sulphide possesses certain physical properties which give it a distinct advantage.

The reaction with calcium sulphide and sulphur dioxide may be represented thus:

$$2\,CaS + 3\,SO_2 = 2\,CaSO_3 + 3\,S.$$

The reaction takes place in the dry state fairly rapidly at a temperature of 100° C., while in the presence of water it takes place readily at ordinary temperatures.

If the mixture of sulphide and sulphur be heated, the free sulphur distills off and the residual calcium sulphite may be reduced at a moderate red heat by means of hydrocarbon oil, whereby the calcium sulphide is regenerated. The reduction is rather difficult except in the presence of small amounts of iron compounds, but when these are present the reduction takes place readily at a low red heat, and, very favorably for the process, the full reducing value of the hydrocarbon oil is realized, that is, the carbon of the oil is oxidized completely to carbon dioxide and no monoxide is produced. The reaction involved is as follows:

$$2\,CaSO_3 + 2\,CH_2 = 2\,CaS + 2\,CO_2 + 2\,H_2O.$$

In practice, if a mixture of sulphur dioxide and hydrocarbon vapor pass together over a mixture of calcium sulphite and calcium sulphide, the reactions given above take place side by side; that is, a portion of the sulphite is attacked by hydrocarbons and reduced to sulphide, which is in return attacked by sulphur dioxide and reconverted into sulphite, and so on. Thus the mixture of sulphide and sulphite serves the purpose of a contact material.

Experiments on a Practical Basis

Experiments toward placing the process on a commercial basis have been carried on for a period of about 10 months, although it may be said that the true development began some three months later with the acquisition of A. M. Hunt, of San Francisco, as consulting engineer, and D. E. Fogg, as chief engineer. All experiments have been carried on at the plant of the Penn Mining Co., situated at Campo Seco, Calaveras County, Calif. Much credit for the results already obtained is due to Charles R. Loughridge, of Denver, Colo., president of the Penn company, and to A. P. Busey and D. C. Smith, respectively general manager and chief metallurgist.

The Penn company operates a battery of eight 6-hearth McDougal roasters, and on first looking over the ground it was decided to attempt operations on such a scale as would cover one unit of this battery, and all experiments have been carried out on this scale. Of course, it is scarcely necessary to say that great difficulties were encountered from the first. The first serious trouble was the great dilution of the gases obtained under the normal conditions of operations at the plant. A careful study of the situation was made, with the result that a device was installed whereby a steady flow of gas carrying 8% or more of sulphur dioxide could be maintained. With dilute gases there is not only an unnecessary consumption of fuel oil, but what is worse, the production of such high temperatures during reaction that serious damage to the plant followed. This damage was partly to the firebrick lining of the reaction or contact chamber, and partly to the contact material itself. This frequently reached a condition of incipient fusion which destroyed the porosity, and the activity of the material. With gases of 8% or more concentration of sulphur dioxide this difficulty was in the main obviated. A further improvement was made by the introduction of a fore-chamber, which carried no contact material, and in which a portion of the excess oxygen was burned out. This resulted in less heat development in the contact chamber, and had the added advantage of delivering the gases to the contact chamber in a preheated condition. By this means the temperature control during operation has been improved to such a degree as to leave little to be desired.

The general scheme of operations in the process is as follows: The roaster gases pass first through a dust settler, which leaves them fairly clean, small amounts of dust seeming to produce no deleterious effect for a considerable time. From the dust chamber the gases pass to the fore-chamber, where a certain amount of oil is introduced. Thence the gases go to the contact chamber, where additional oil is introduced. The relative amounts introduced at the two places are adjusted by the temperature conditions which establish themselves in the contact chamber, the total amount being that necessary to burn out oxygen and reduce sulphur dioxide. The contact material is made up from plaster of paris, which is mixed with water containing a small amount of iron salts, allowed to set and

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then broken into lumps. The issuing gases containing free sulphur pass to cooling and condensing apparatus, where the sulphur deposits. Up to the present time practically no attention has been paid to the matter of condensation, other matters claiming all the time and energy of the experimenters. Sulphur has, however, been condensed several times on a small scale, but in a purely incidental way. Ordinarily it has been allowed to escape directly from the contact chamber at high temperature, under which conditions it reburns to sulphur dioxide.

Aside from the difficulties mentioned above, many others have, of course, presented themselves. These may be roughly divided into mechanical and chemical. As to the mechanical difficulties, they have to do mainly with the design and capacity of the reaction chamber, and the proper disposal of the contact material. Four different types were tried before satisfactory results were obtained. The type in present use is satisfactory, and affairs in the interior are under good control. The design contains certain original features which render a detailed description of it at this time inadvisable. Other mechanical difficulties were met in the proper regulation of the relative flows of roaster gases and oil, a problem which has already been satisfactorily solved.

Chief Chemical Difficulty Is Poisoning of Contact Mass

The chief chemical difficulties met have had to do with the poisoning of the contact material. There are three things which may cause this result. If excessive flue dust enters the contact chamber, the contact mass becomes sooner or later coated with it and its activity rapidly falls. This is remedied by reducing the flue dust to a minimum, small amounts having, as stated above, but little effect.

High temperatures also have the effect of destroying the activity of the contact material. This difficulty has also been avoided as described above. The third source of trouble in this direction is the presence of certain foreign substances, which destroy the activity of the material. A number of such instances have been found, none of which, fortunately, occurs in the roaster gases. The action of these substances is somewhat obscure and will be made the subject of further investigation when opportunity offers. At present it is sufficient that their deleterious effects have been avoided.

As to the actual results that have been obtained up to the present time, the plant has been run for periods of 10 and 12 days upon the same charge of contact material without loss of activity, during which time any degree of reduction desired could be obtained. There has been no difficulty whatever in establishing and maintaining exit gases with practically no sulphur dioxide. It must not, however, be concluded from this that all the problems are settled.

Certain, not inconsiderable, difficulties remain to be solved, but it is the opinion of those interested in the development of the process that these remaining problems offer no serious menace to the ultimate success of the process.

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Radium Preparations produced in 1911, by the Austrian Radiumpraeparatefabrik, according to official reports, amounted to 14.146 grams containing 2.647 grams of pure Ra Cl_2, valued by the makers at $214,900. This is at the rate of $2,301,000 per oz. of radium chloride.

Goldfield Consolidated in December

During December, 1912, the total production was 27,903 tons, containing $457,951, or an average of $16.41 per ton, of which 27,651 tons were milled with an average extraction of 94.28%, and 252 tons of an average value of $24.04 per ton were shipped, the net recovery from all ore being $15.48 per ton. The net realization to the company was $270,561, or $9.69 per ton.

During the month 3297 ft. of development work was performed. The total cost of mining, development, transportation, milling, office and general expense was $5.72 per ton, distributed as follows:

Mining, including stoping and development	$3.07
Transportation	0.07
Milling	2.12
Marketing	0.06
General expenses	0.45
Bullion tax	0.07
Construction	....
Marketing ore	0.01
Total cost of operation	$5.85
Miscellaneous earnings	0.13
Net cost per ton	$5.72

At the Combination mine, Gen. Supt. J. F. Thorn reports that the new orebody on the second level was opened cut to a considerable extent during the month. The 136 BX sill being cut in it, produced 906 tons of ore averaging $70 per ton. In the Mohawk, the 3-P sill on the 150-ft. level in the old Sheets-Ish ground produced 289 tons of ore, averaging $19.20 per ton. In the Clermont, the 649 drift just below the 900-ft. level, 750 ft. south of the shaft, encountered the downward extensions of the 534 orebody, and produced 38 tons of ore averaging $28.20 per ton. The sill of the 802-A stope, on the 1300 level of the Grizzly Bear, produced 287 tons, averaging $46.55 per ton, which was shipped to the smeltery. The development of the 1400-ft. level was slow, owing to a large flow of water encountered early in the month, necessitating the installation of additional pumps. The work of prospecting the latite quartz mass for the downward extension of the 1300 orebodies was carried forward steadily.

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Guggenheim Exploration Co

The balance sheet of the Guggenheim Exploration Co., as of Dec. 31, 1912, listing its chief assets, follows:

GUGGENHEIM EXPLORATION CO. ASSETS

Security	No. of Shares	Value	Per Share
Am. Sm. Sec. pfd A	44,000	$3,960,000	$90.00
*Utah Copper	404,504	9,161,767	22.65
*Yukon Gold	2,834,885	10,091,189	3.56
*Chino Copper	97,750	2,534,803	25.93
*Am. Sm. & Ref. com	69,500	4,764,265	68.59
*Ray Con	121,200	2,585,638	21.33
*Misc. Investments		53,010	
*Alaska-Yukon		1,144,102	
Furniture		2,310	
Accounts Collectible		4,550	
Cash and Demand Loans		10,303,299	
Total		$44,607,933	
LIABILITIES			
Capital stock, issued		$20,793,300	
Surplus		23,814,633	
Total		$44,607,933	

The items marked* are carried at cost in both the 1911 and 1912 balance sheets. The net income of the Exploration Co. was $3,271,750, of which $2,079,330 went for dividends; $340,455 to surplus; and $660,000 to writing down the difference between balance-sheet value and sale of the 110,000 shares of Securities stock. The balance of $191,965 is not specifically accounted for, but was apparently written off on other items.

DETAILS OF PRACTICAL MINING

Portable Scaffold for Drilling High Roof

There is in use at the mines of the Alpha Portland Cement Co., Mannheim, W. Va., an interesting device for drilling high roofs. Above a bed of limestone 26 ft. thick, says William M. McKearin, in the January *Mine and Quarry,* there lies a thin bed, 8 to 12 in. thick, which cannot be pulled when mining the main bed, but which constitutes a menace if left, as it slabs off and falls. In order to drill and blast this, the rig shown in the accompanying illustration was devised. The staging is built on wagon axles, lengthened to 9 ft. 6 in. and is 20 ft. high. The frame is 8x8 ft. at the bottom, and the platform on top is 3½x4½ ft., with a railing 3 ft. high. An extension, shown in the picture, can be placed at either side, so that the driller may reach beyond the limit of the platform proper for barring down loose slabs. The standards are 4x4-in. and the braces 2x4-in. timber. Two ladders run to the top of the platform. The outfit is hauled about the mine by a horse.

HIGH-ROOF DRILLING RIG

The drills used are Sullivan air-feed stopers (Class D A-21). Using two outfits, 50 to 60 holes are drilled and loaded in a 10-hr. shift. These are 8 to 10 in. deep and are spaced at intervals of 2 ft. in lines 6 ft. apart. From 2 to 4 in. of 1-in., 40% dynamite is used per hole. The plan has proved satisfactory, eliminating all danger and bringing down a quantity of good stone at small cost.

Short Range Plane Table

In an established camp or around a mine with extensive holdings, there are usually a large number of survey points, definitely and accurately located, such as claim corners and triangulation stations. If it becomes necessary to make a topographic or a topographic-geologic map of the country, advantage can be taken of these known points as a skeleton survey and the filling-in done to good advantage with a plane table. When the known points are not too far apart and the sights are short, only a very simple and light outfit is needed, and such a one, especially adapted to rugged country and large-scale mapping, is described by E. F. Pelton and D. D. Irwin, in *Econ. Geol.,* December, 1912. The table was of soft pine, ½x15x18 in., cleated at both ends to prevent warping. A ⅛x3-in. circular brass plate, provided with a threaded hole to receive the tripod screw, was attached by countersunk screws, flush with the bottom of the table. An Eastman No. 4 combination tripod was used for mounting.

For leveling purposes, two carpenters' level-bubbles were set at adjacent corners in the edges of the table with plaster of paris. A small wooden box for the drawing instruments was pivoted by a screw through one end to the under side of the table, so that it could swing out, being held in place by a spring wire when closed. A strip of emery cloth for pointing pencils was attached to one edge of the table.

The map was drawn on buff drawing paper or white paper, lightly washed with brown, to avoid excessive glare from the sun. On this paper there were first plotted all the known points and a light line was drawn the full length of the map, corresponding to the magnetic north for the current year. The alidade used was of the Graton improved type made by Bausch & Lomb, consisting of a 7½-in. straight-edge with open compass sights and a delicate needle mounted on a compass box midway between the sights. The sights themselves folded down and the whole instrument fitted in a leather case, which could be carried on the belt.

A hand stadia with a ball-and-socket leveling attachment and a slow-motion screw, mounted on a separate camera tripod, was carried safely in a leather sling case. The stadia rod consisted of a 6-ft. folding rule graduated to feet and tenths. Targets of the usual pattern were made of linen-backed drawing paper; the upper one was attached to the rule by paper clips, while the lower was moved up or down in front of the rod. Readings were called out or communicated by signals when necessary. A

stadia slide-rule was used for reducing readings or a conversion table was tacked to one corner of the plane table. A celluloid protractor-triangle graduated to degrees, notebooks, erasers, pencils, lens and scale completed the equipment. The rodman carried a Brunton compass, notebook for sketching details and geologic pick.

The location, determination of elevation and general methods of procedure did not differ greatly from ordinary plane-table work, but the rodman was accustomed to take the bearings of the contours as well as slope angles and to collect geologic specimens. Accurate results were obtained in working on a scale of 200 ft. to the inch. The whole equipment weighed only 12½ lb., and $55 more than covered its cost.

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Weir Measurement Devices

By H. S. Knowlton*

Small hydro-electric plants or direct-acting water-power plants are very common in the mining industry. Frequently it becomes necessary, in cases of proposed enlargments, improvements or changes, to obtain measurements of water flow. Usually precise instruments are not obtainable and results approximately correct only are required. In one case of this nature it was found possible to obtain exact data at practically no expense. It was necessary to measure the flow in the tailrace of a hydro-

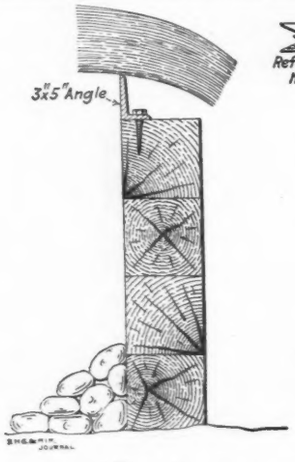


Fig. 1

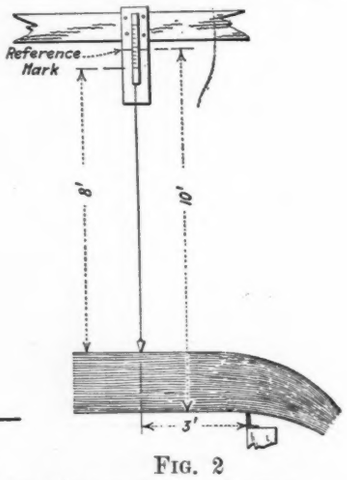


Fig. 2

Improvised Weir and Measurement Device

electric plant, and advantage was taken of a timber dam, previously built to seal the draft tubes. A 3x5-in. angle was fastened with lagscrews to the top timber of the dam, as shown in Fig. 1, the long leg being vertical and flush with the inner side. As the dam extended the full width of the tailrace, there was no end contraction. The angle furnished the sharp edge required by the weir formula.

In order to measure the head, a reference point was set 10 ft. above the crest. A scale was marked on a stick and a plumb-bob suspended from it so that the point of the bob was exactly eight feet from the zero of the scale, as shown in Fig. 2. When the point of the bob touched the water, the distance was read off as eight feet plus the fraction of a foot shown on the scale opposite the 10-ft. reference mark. This distance subtracted from 10 ft., gave the head of water above the weir.

*Newton, Mass.

Drawing Cabinet and Filing System

A cabinet for filing drawings, used at Mineville, N. Y., by Witherbee, Sherman & Co., is shown in detail in Fig. 1 of the accompanying illustrations. Each shelf is supplied with heavy paper folios or folders to protect drawings from the dust. The larger folio measures 33x39 in., the smaller 18x24 in., the bound portion of the two leaves being placed to the rear of the drawers. In order that the folders may be easily slipped in on a drawer, it is preferable to make the ⅝-in. bottom of the shelf continuous and not latticed, as shown. The corners of the folios cannot then catch on the ⅝x3-in. cleats, curl up and provoke cussing. The two sizes of folios, so that drawings may be assorted as to sizes, will be found advisable, for with one large folio housing all sizes a 15x18-in. drawing may be overlooked in haste.

The drawers are numbered; numbers cut from calendars may be arranged, then traced with drawing ink and

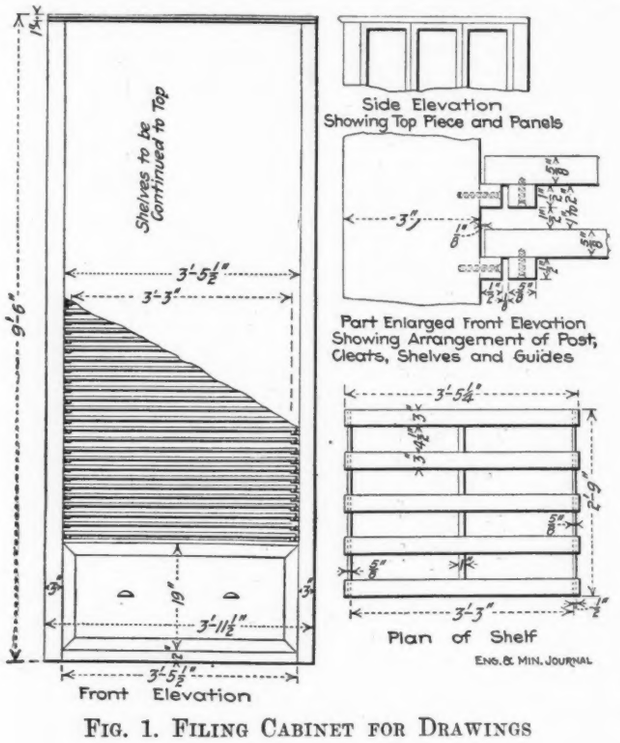


Fig. 1. Filing Cabinet for Drawings

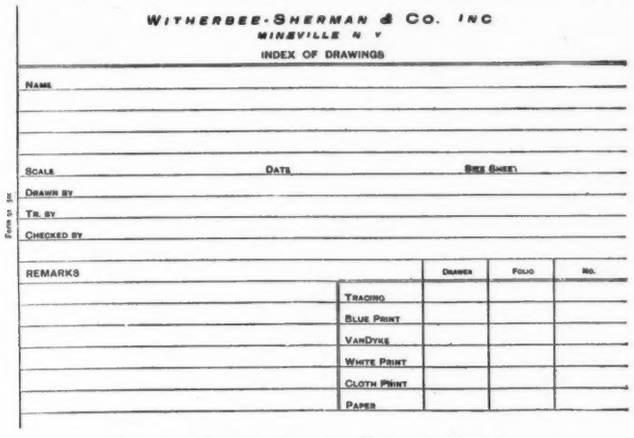
the tag pasted on the shelf. A window shade hung at the top of the cabinet will protect the folios from dust. The bottom drawer is large; it may be used for the drafting-room supplies.

A filing system, as outlined below, has been found convenient. Before titling a drawing, a loose-leaf book is consulted, to learn which drawer is being used, and also the number of the last drawing which has been recorded in the book. The shelves are numbered 1, 2, 3, 4, 5, etc., and after a shelf, which may contain several folios, has a sufficient number of drawings, a check mark is placed on the pages alloted to the shelf in the loose-leaf book. The next drawings are then filed in the shelf above.

All drawings are made on sheets of the following sizes, dimensions being for outside of sheets: 28½x40½ in.; 28½x36 in.; 24x36 in.; 24x30 in.; 18x24 in.; and 15x18 in. The title is placed in the lower right-hand corner of all drawings, and each is numbered for the drawer and

folio then in use. Drawing 24-2-16 would refer to drawer 24, folio 2 and drawing 16. Drawings are indexed on loose-leaf sheets 5x8 in., Fig. 2. An electrical-equipment record is kept on sheets of the same size, Fig. 3. The mechanical-equipment record is similar.

In the engineering department, seven loose-leaf binders are used, labeled as follows on the heavy fly leaf: 1, Mine and surface maps; 2, Shops; 3, Mills; 4, Power plant; 5, Mechanical equipment; 6, Electrical equipment; 7, Correspondence, estimates, etc. Each binder has gold-lettered, red-leather index tabs, for marking the main subjects, projecting at the top. Each main subject is then cross-indexed by means of blank sheets of heavy material, having yellow tabs projecting at the end of the binder at right angles to the main-subject tabs. These yellow tabs are lettered with drawing ink.


WITHERBEE-SHERMAN & CO. INC
MINEVILLE N Y
INDEX OF DRAWINGS

NAME

SCALE DATE SIZE SHEET

DRAWN BY

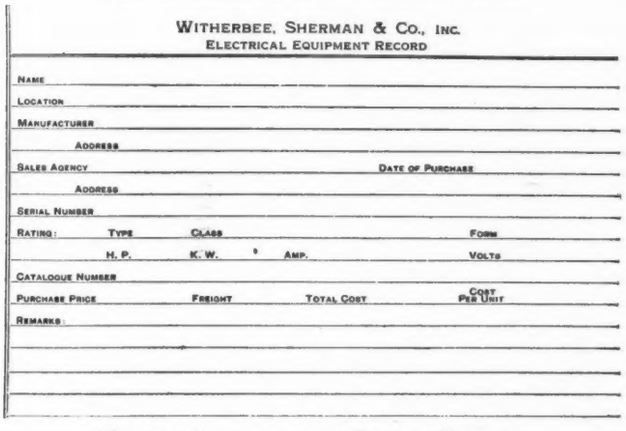
TR. BY

CHECKED BY

REMARKS

	DRAWER	FOLIO	NO.
TRACING			
BLUE PRINT			
VANDYKE			
WHITE PRINT			
CLOTH PRINT			
PAPER			

FIG. 2. CABINET AND FILING SYSTEM


WITHERBEE, SHERMAN & CO., INC.
ELECTRICAL EQUIPMENT RECORD

NAME

LOCATION

MANUFACTURER

ADDRESS

SALES AGENCY DATE OF PURCHASE

ADDRESS

SERIAL NUMBER

RATING: TYPE CLASS FORM

H. P. K. W. AMP. VOLTS

CATALOGUE NUMBER

PURCHASE PRICE FREIGHT TOTAL COST COST PER UNIT

REMARKS

FIG. 3. CABINET AND FILING SYSTEM

❖

Molten Slag Revetment

Along a certain stretch of the Wheeling & Lake Erie R.R., where it borders the Ohio River, it was found that a fill which had been widened for double-tracking was subject to bulging in wet weather from the pressure of the hill behind and was also being eroded by the action of the river, according to *Engineering News*, Jan. 30, 1913. In order to present a smoother surface to the eroding current and also to bind the revetment and form a stiffer resistance to the pressure of the hill, it was decided to coat part of it with molten slag. This method proved extremely satisfactory, as the slag could be handled in quantities of from 500 to 600 cu.yd. per day, hauling it a distance of about two miles in 9-cu.yd. ladles. The ladles were tipped by power and could be poured slowly so as to regulate the flow of the slag, thus building up the wall on a uniform slope. The original slope of the hill was increased from 1 on 1 to 1½ on 1, and at points where the river was low and the bottom of the wall exposed, an additional trench was dug, heaping the earth on one side to prevent the slag from flowing into the river. The original revetment had been of heavy mill slag built in the form of a wall along the face of the slope and started in a trench, which acted as a toe hold.

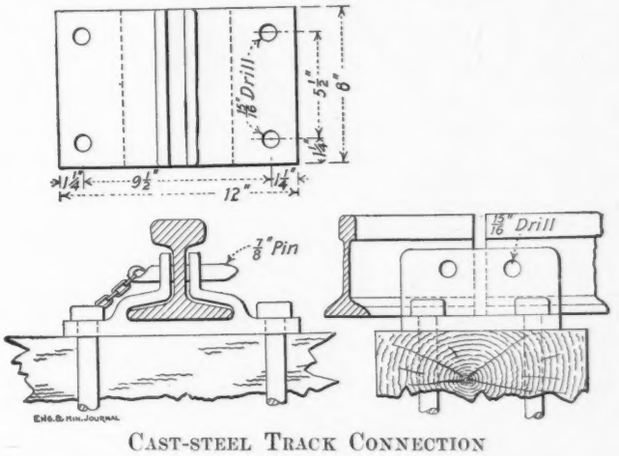
At other points a mortar mixture of five parts of clean, sharp sand to one of cement was applied with a cement gun for grouting the revetment voids. This material was placed at the rate of about 15 cu.yd. per day, covering 1050 sq.ft. This method was satisfactory, but more expensive, costing about $6 per cu.yd. of mortar placed, while the slag cost about $0.17 per cu.yd. Apparently, however, a given quantity of mortar would cover more area than would an equal amount of slag.

❖

Steam Shovel Track Connection

BY E. C. HINGSTON*

The rail chair or track connection illustrated in the accompanying drawing has the advantage over a track connection described in the JOURNAL of Dec. 28, 1912,



CAST-STEEL TRACK CONNECTION

of affording greater rigidity, as the vertical flanges fit under the head of the rail and prevent a sideways roll. The chair, made by the Bucyrus Co., is a steel casting fitting loosely over the rail, its length corresponding to the width of a tie, eight inches.

In steam-shovel work, the new track usually lies on an upgrade, as the shovel tends to imbed the section on which it rests. This fact, combined with the rough bottom and the necessity of providing for side swing, accounts for the large clearance allowed, the short length of the casting and the placing of the holes for the pins near the ends of the rolls. The pins are not threaded and can be quickly inserted and removed. They are chained to the casting to prevent losing.

❖

An Innovation in Milling Practice in the Black Hills of South Dakota, is being tried out in the Trojan cyanide plant. A belt elevator is used to lift the Chilean-mill product to the Dorr classifiers. The housing of this elevator is entirely of steel and the boot is made of concrete.

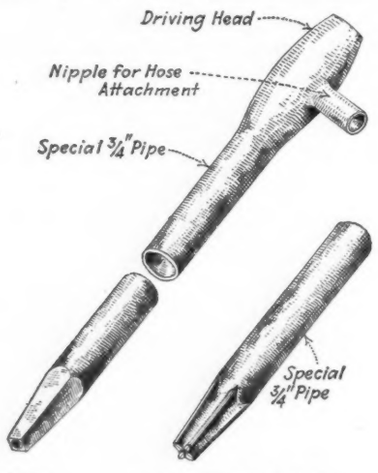
*Bucyrus Co., South Milwaukee, Wis.

Steam Points Used in Thawing

By Henry Mace Payne*

The steam point commonly in use for thawing ground throughout the frozen districts of Alaska, Yukon Territory and Siberia, is shown in Fig. 1. The pressure at the point naturally varies with the length of transmission, but is usually about 15 lb. Much difficulty is experienced where large boulders are encountered on account of the deflection of the point while driving. In some cases this deflection becomes so great that the points, which are made of special ¾-in. pipe, pull apart when being withdrawn.

To obviate this difficulty the point shown in Fig. 2 was devised during the last summer. This arrangement is made by welding on the end of the pipe a regular cross-shaped bit point, through the four flutes of which



Steam Thawing Points

are drilled holes converging into the interior of the pipe. Its purpose is to cut the frozen boulders until they split, and by having the four orifices, to avoid plugging while driving.

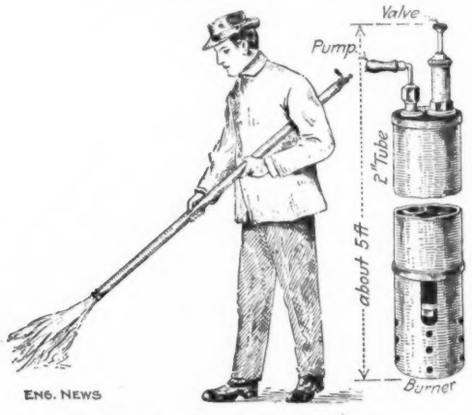
Tuff Cement

Several features of interest attach to the construction of the new Los Angeles aqueduct, among which the operation of municipal cement plants and the use of ground tuff with portland cement have excited considerable comment. Deposits of material suitable for portland cement as well as beds of tuff were found near the line of the aqueduct and mills were erected at three different points to grind the materials on the spot. The tuff cement, as it is known, was compounded of equal parts of ground tuff and ground portland cement and then reground in a tube mill. It seems to be closely related to the Italian puzzuolana and the German trass cements on the one hand and to the sand-cement specified for U. S. Reclamation Service dams on the other. The great advantage claimed for it is its cheapness. When the aqueduct work was started, commercial portland cement was sold in Los Angeles for $2.25 per bbl. The city manufactured its own portland for $1.30 per bbl., and the tuff-cement for $0.83 to $0.86 per bbl. This economy is not effected, however, at the expense of quality. It is urged that the 1:1 combination makes a mortar slower to set, but increasing in tensile strength for several years; that while a rich mortar is slightly weaker in compressive strength, a lean mortar is as strong as one made of straight portland; that it is more flexible, more dense and impervious and more satisfactory under water, but it is admitted that it is more sensitive and requires care in handling, special precaution being necessary against drying. It is claimed by many that the tuff added to the portland is inert, and compensates for the dilution by grinding the portland much finer in the regrinding process so that large inert grains become active. While this may be the case with sand-cement, it has been proved that with the tuff, an actual change in chemical reaction takes place in setting, and that as the tuffs are highly siliceous, silicates of lime are formed. These are the slower elements in a cement, but the ultimately stronger. The use of tuff-cement does not find favor with the portland-cement manufacturers, who maintain that the tuff is only an adulterant and that its use would tend to bring into disrepute the whole cement industry.

*Mining engineer, Stephen T. Williams and Staff, Inc., 50 Church St., New York.

Gasoline Torch for Thawing

A new type of gasoline torch, shown in the accompanying drawing, has been placed on the market and appears to be peculiarly adapted for such work as thawing frozen



Gasoline Thawing Torch

pipes, cleaning ice and snow out of switches and taking the frost out of frozen ground for excavations. As described by *Engineering News*, Jan. 23, 1913, it consists of a 5-ft. tube of heavy brass with a burner at one end and a valve and pressure-pump at the other. An inside valve regulates the flow and permits its use in any position. The air pressure and special burner give a greater heat and volume of flame than does the ordinary torch. The size of the flame can be regulated, a length of 12 in. being obtainable. The torch, which is made by the Turner Brass Works, Sycamore, Ill., weighs about seven pounds and holds three quarts of gasoline, sufficient for three hours use.

Cyclopean Rubble Concrete will form the greater part of the new Elephant Butte and Arrowrock dams of the U. S. Reclamation Service. The specifications, as given by "Engineering News," call for the placing of large stones by derrick in the freshly deposited mortar. These stones must be sound, strong and clean, and must be joggled into place so as to secure a strong bond. It is recommended that in the space between the larger stones, smaller stones be imbedded in the concrete.

DETAILS OF METALLURGICAL PRACTICE

Launder Data, Cananea Consolidated

By A. T. Tye and T. Counselman*

In the accompanying table is given information concerning the launder system installed at the concentrating plant of the Cananea Consolidated Copper Co., Cananea, Sonora, Mexico. This should prove useful as a guide to those having to install launders where it is impossible to make preliminary tests. In order that comparison may be made the character of the ore handled is also given.

The country rock in which the copper ores are found is principally diorite. The remainder of the ore is obtained from deposits in limestone, quartzite and quartz porphyry. The principal minerals in the concentrating ore are pyrite, chalcopyrite, bornite, chalcocite, native copper, garnet, sphalerite, galena and oxides and carbonates of copper.

LAUNDER DATA, CANANEA CONSOLIDATED COPPER CO.

Material Handled	Size of Launder Inches Depth	Width	Grade in. per ft.	Lining	Ratio Solids: Liquids	Largest Particle mm.	%Wt. on 60 Mesh
Original feed to Section "C"	10	x12	3¼	C.I.—11¼"	1:1	30.0	82.0
Bull jig tails, to coarse rolls	10	x 9½	3	C.I.— 9½"	1:1.1	28.0	98.0
Roll jig tails, to fine rolls	10	x 7½	2¼	C.I.— 7½"	1:3	10.0	98.0
Coarse jig concentrates	10	x 7½	1¼	C.I.— 7½"	1:2.9	35.0	95.0*
Undersize 2 mm. trommel to classifier	10	x 5½	1½	C.I.— 5½"	1:4.4	4.0	52.0*
1st spigot of classifier to sand jig	8	x 5½	3½	C.I.— 5½"	1:1.5	4.0	90.0
Shaking launder[1] for sand jig concentrates	6½	x12	½	None—corners	1:19.0	4.0	84.0
Fine jig concentrates from shaking launder	10	x 7½	1 1/16	C.I.— 7½"	1:6.0	4.0	80.0
Bryan (Chile) mill discharge to drag belt	8¾	x11½	3/16	None—corners	1:1.7	2.5	26.0
Drag belt sands to classifier distributor	10	x 7½	1¼	C.I.— 7½"	1:0.9	2.5	46.0
No. 1 spigot of classifier to mud jigs	8	x 5½	1½	C.I.— 5½"	1:17.0	3.0	60.0
Table feed, tables 27 to 30	7½	x 5½	½	None—corners	1:8.4	1.0	0.3
Table concentrates, drag belt launder[2]	9¾	x 9½	½	1½" boards	1:26.0	1.0	13.6
Table concentrates, shaking launder[3]	4	x 7½	½	None—corners	1:7.4	0.5	35.2
Slimes, section "C", settling tanks to Section "B" vanners	6½	x 9½	1/16	None	1:96.0	0.17	0.0
Slime feed to vanners, Section "C"	9½	x11½[4]	½	None	1:4.7	0.17	0.5
Vanner concentrates, drag belt launder[5]	10	x25x16	Level	None	1:31.0	0.2	1.0
Vanner and table concentrates	6½	x 6	1 1/16	None	1:20.0	2.0	27.2
Vanner tails, Section "C"	9½	x11½	½	None—corners	1:7.0	0.4	0.4
Coarse tails, table and jig	9½	x22	½	½" boards & corners[6]	1:27.0	2.0	41.6*
Coarse sand tailings to dam No. 2	12¼	x11½	½	½" boards & corners[6]	1:21.0	2.0	19.5*
Coarse sand tailings to dam No. 1	12	x11	½	½" boards & corners[6]	1:21.0	2.0	19.6*
Slimes to mill No. 4	9½	x12½	½	None—corners	1:4.4	0.1	0.0
Sands and slimes to mill No. 3	10	x11½	½	None—corners	1:5.0	1.5	2.6
Feed to vanners, mill No. 4	6	x 7½	½	None	1:4.4	0.1	0.0
Slime concentrates, mill No. 4, drag belt launder	12	x24x18	Level	None[2]		0.1	0.2
Slime concentrates, mill No. 4, elevator to bins	7	x 7½	½	Glass—corners[7]	1:20.0	0.1	0.4
Slime concentrates, mill No. 3, elevator to bins	10	x12	1/16	Concrete	1:8.7	0.2	2.8
Slime tails, mill No. 4, to mill No. 3 settling tanks	10	x11	½	None—corners	1:6.3	0.1	0.0

All cast-iron liners have 2-in. effective depth and 24-in. length, with corners rounded.
* Liable to choke. [1] Speed 160 r.p.m., actuated by heavy head motion. "Corners" are strips of wood with cross-section of 45° triangle nailed in corners of launder. [2] Speed 75 ft. per min.; old 4-in. drive belts are used, no scrapers [3] Speed 180 r.p.m. [4] Effective width 6 in. [5] Speed 75 ft. per min. [6] Boards laid with grain across direction of flow. [7] Glass liners, ¼x4x14 in.

The accompanying analysis of crude ore represent the typical sliming and nonsliming ores. Although so different in physical characteristics as regards slime-forming qualities, their chemical composition is remarkably similar.

ANALYSES OF CRUDE ORE AND TAILING AT CANANEA CONSOLIDATED CONCENTRATOR

	Copper %	Silica %	Alumina %	Iron %	Lime %	Sulphur %
Crude ore:						
Maximum slimes, rock decomposed	2.42	51.0	14.3	10.8	1.2	10.5
Minimum slimes, rock hard	1.50	57.0	12.7	6.2	1.0	6.6
Concentration tailing:						
Coarse tails, to No. 2 dam	0.72	67.6	17.5	1.8	1.2	1.4
Slimes to No. 4 mill	1.02	76.6	11.3	2.2	1.0	4.0

The concentrates assay approximately 6.86% Cu, 18.6% insoluble, 31.5% iron, 36.2% sulphur. The composition of the tailing after concentration is shown in one of the accompanying tables. The specific gravity of the pyrite is 4.84 and of the chalcopyrite, 4.17. The coarse sands have a specific gravity of 2.7 and the fine slimes, 2.8. Thanks are due to F. J. Strachan, superintendent of the plant, for permission to publish the above data.

*Concentrating Department, Cananea Consolidated Copper Co., Cananea, Sonora, Mex.

Area of Amalgamating Plates

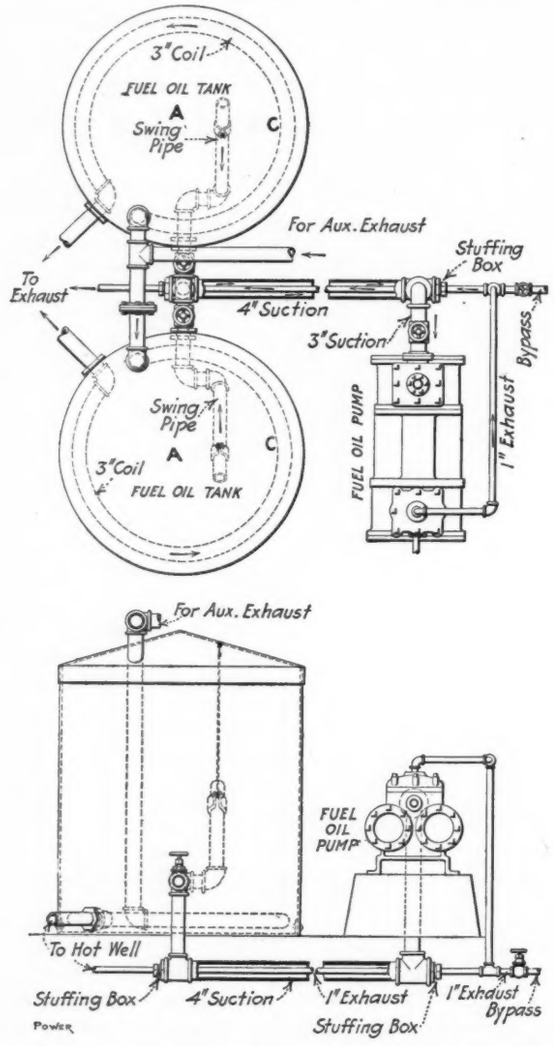
In discussing the paper of A. J. Clark and W. J. Sharwood, H. A. White dwells on the enormous area of copper plate in use at the Homestake plant (*Bull.* I. M. M. No. 100, Jan. 9, 1913). This amounts, roughly, to 12 sq.ft. per ton milled per day, and may be compared with the case of the Princess Estate, Witwatersrand gold fields, where the recovery by this process has been, for the months of September, October and November, 1912, 73.10%, 73.54% and 74.13%, respectively, and therefore even higher than the excellent figures quoted, though allowance must be made for a somewhat higher grade of ore.

At the Princess Estate the total plate area per ton of ore milled per day is 1.4 sq.ft., of which two-thirds is employed upon the tube-mill outflow, and the remainder upon feed-cone overflow. From the launder leading away to the cyanide plant only 20 oz. of gold were recovered after 12 months' run, though this is provided with baffle strips.

The temperature of the pulp has risen as high as 110° F., but only slight improvement in amalgamation results from increased heat. The alkalinity of the mill water is kept as nearly as possible equivalent to 0.010% NaOH and it should be obvious, says Mr. White, that ill effects of temperature, where easily oxidizable sulphides are present, will be changed to advantages when the inhibiting effect of the presence of excess alkali is utilized.

Heating Fuel Oil

In cold weather the heating of fuel oil becomes necessary in most installations. One plant, according to *Power,* met the situation by using the equipment shown in the accompanying illustration. The oil was of 14° Bé., which is stiff at 60° F., and gave the best results when heated to 120° F. in the tank, allowed to stand at that temperature for about four hours, giving time for most of the moisture to settle, and then heated in a closed line to 140° F. before reaching the burners.



TANK, PUMP AND CONNECTIONS FOR FUEL-OIL HEATER

Each of the fuel tanks *A* is of 100-bbl. capacity, and contains a 4-in. suction line with a swing pipe, which may be hooked to draw from any depth. The oil follows the arrows to the fuel-oil pump, the 1-in. exhaust of which can be connected to a pipe passing through the oil suction line, stuffing boxes being provided at each end.

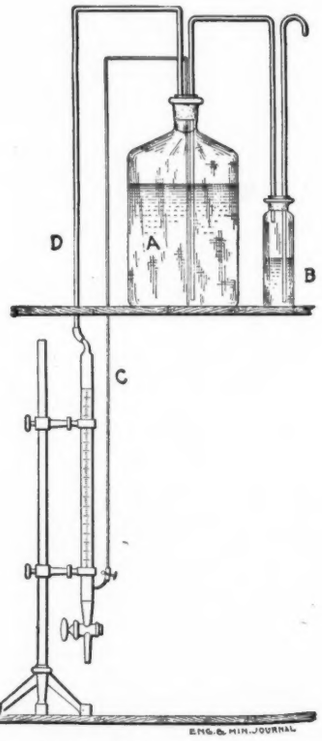
Each tank contains a 3-in. coil *C,* which receives exhaust steam from the feed-water pumps, etc. This heats the oil enough to settle the moisture but not enough to cause a loss of vaporization.

After the oil has entered the 4-in. suction pipe and is on its way to the pump, it may be heated to 140° F., or even higher without a loss of the lighter oils or distillates.

Keeping Acidimetric Solutions Constant

An apparatus is described by Doctor Lindt in *Metall und Erz,* Dec. 8, 1912, for the protection of volumetric solutions, especially alkalimetric and acidimetric, which we reproduce here as modified by Dr. C. Glaser, of Baltimore, Md. The standard solution is kept in bottle *A,* and the small bottle *B* is kept partly full of the same solution. *C* is the usual form of siphon feed to the burette. *D* is a tube fitting in a rubber stopper in the top of the burette and leading back through the three-hole stopper in *A.* This device thoroughly protects the standard solution from all changes due to contamination by acid or alkali vapors in the air getting into the container, as well as from change due to evaporation into air of varying humidity, such as would be drawn directly from the atmosphere.

The only admission of air is during titration, when air is drawn into the burette through *D* from *A,* and is drawn into *A* from *B.* The standard solution will be run



KEEPING STANDARD SOLUTIONS

from the burette slowly, and the admission of air into *B* will be bubble by bubble, a thorough washing of the air being obtained by the solution in *B.* This immediately gives it the same vapor tension as exists in *A.* When the burette is refilled from *A,* the burette and *A* form a closed circuit, air from the burette simply going back to the bottle.

In *Metall und Erz,* tube *D* is omitted, the top of the burette being protected by a glass cap. This results in unwashed air being drawn into the burette during titration, and to drawing in air through *B* when filling the burette, giving a rapid flow of 50 or 100 c.c. of air through the wash solution, instead of a slow flow of only a few cubic centimeters.

NOTES FROM CURRENT LITERATURE

Hydrothermal Alteration of Granite

At the St. Anthony mine, in northwestern Ontario, the Sturgeon Lake granite intrudes the Keewatin rocks and near the border of the contact is a greatly disturbed zone where fissures formed in the granite on contraction have been largely filled with quartz. Close to these fissures, writes Elwood S. Moore, in *Econ. Geol.*, December, 1912, the change in appearance of the granite, quite distinct from the results of weathering, points to strong hydrothermal action having taken place. The granite, which normally shows quartz, albite, orthoclase and biotite, has been altered to a rock composed of quartz and muscovite alone. This alteration extends away from the vein for a distance varying from an inch to 12 feet.

Careful analyses were made of fresh granite, partially altered material, and material close to the vein and the following conclusions were drawn: The most important changes in the chemical composition of the granite are: A loss in silica, which apparently served, to some extent, to build up the quartz veins; a relative increase of alumina; a loss of calcium, potash and sulphur; and an increase in iron and soda. The chief mineralogical changes are an alteration of the feldspars to scaly mica, sericite and paragonite; a recrystallization of the quartz with partial segregation into veins; oxidation of pyrite and its partial removal; and an introduction of sulphides with the vein quartz.

⁂

Construction of Lead Chamber Walls

The structural properties of sheet lead are poor and great care is required in designing, to insure that the lead is subject only to simple stresses of small magnitude (*Zeit. angew. Chem.*, 1912, p. 2523; abstr. *Journ.* Soc. *Chem. Ind.*, Jan. 15, 1913, p. 21). In constructing lead chamber walls the author, Awe, recommends a horizontal suspension of the sheets. The carriers consist of horizontal angle irons, over which is laid a lead angle or the bent-over edge of the lead sheet. This is clamped to the angle iron by means of a strip of flat iron with bolts, and the joint made by soldering in the usual manner. Assuming that the thickness of the lead is 3 m.m. and that the horizontal angle irons are 1.5 m. apart, the lead having a specific gravity of 11.3, then the tensional stresses in the lead are only about 2 kg. per sq.cm. No other stresses occur, since the attachment to the angle irons is uniform. The distance between the vertical supports of the angle irons may be fixed at will, the only condition being the absence of sagging. With light angle irons the supports may be 3.75 to 4.25 m. apart and thus a space of approximately 6 sq.m. is left clear for repairs. On the other hand, the use of vertical carriers for the lead sheets sets up large and not readily calculated stresses, the carriers must be set closely together to counteract the tendency for the lead to give way at the seams and this allows little space for repairs. When repairing, it is necessary to undo one of the vertical attachments which increases the stresses and easily leads to deformations. The trouble is magnified when the upper ends of the carriers are attached to the roof-girders or other vibrating portions of the structure.

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The Detection of Carbon Monoxide

Two methods for the detection of small quantities of carbon monoxide in the air were described recently before the Paris Académie des Sciences. The first method, the idea of Armand Gautier, is based on the reduction of iodic acid by carbon monoxide at temperatures varying between 60° and 80° C. The air is collected in an aspirator, and then passed into a vessel containing iodic acid at 70° C. The iodine is passed into a tube of chloroform which assumes a pink coloration varying according to the amount of carbon monoxide present in the air, which is estimated by comparison with the color of tubes containing a known quantity of iodine in the same volume of liquid. By this method, says the *Chemical Trade Journal*, Jan. 18, 1913, it is claimed that one part of carbon monoxide in 200,000 parts of air can be detected.

In the second method, described by M. Guasco, it was shown that the rise of temperature indicated by a mercurial thermometer, the bulb of which is covered with platinum black, is only a few tenths of a degree for each one-tenth of 1 per cent. of carbon monoxide present. In order to obtain thermometric differences easily discernible, use is made of Leslie's differential thermometer, one of the bulbs of the U-tube being coated with platinum black. By means of an outer cover the bulbs are protected from direct contact with the atmosphere, the air penetrating through a porous partition in the outer covering. Any change in the levels of the liquid in the U-tube is noticeable, and the proportion of carbon monoxide present in the air is indicated by a graduated scale.

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The Separation of Iron and Manganese

A new method for the separation of iron and manganese was described by F. H. Campbell, of the University of Melbourne, before the Society of Chemical Industry (*Journ. Soc. Chem. Ind.*, Jan. 15, 1913). The separation depends on the fact that when a solution of an iodide and iodate is added to a solution of a ferric salt, the iron is precipitated as a light-brown hydrated ferric oxide, which can be readily filtered and washed. The directions, which must be closely followed, are as follows:

The cold solution of iron and manganese salts, preferably as sulphates, is almost neutralized with ammonia, and a mixture of equal volumes of a 25% potassium-iodide solution and of a saturated solution of potassium iodate is then added. The precipitate is allowed to settle, the liberated iodide removed by the addition of a slight excess of 20% sodium thiosulphate solution, and the precipitate is again allowed to settle; the supernatant liquid

is then decanted through a filter, to which the precipitate is next transferred and washed with water, the temperature of which is gradually increased, the final washing being with boiling water. The filtrate is made acid with dilute hydrochloric acid and about 5 c.c. of a saturated solution of ammonium phosphate and 20 grams of solid ammonium chloride are added. The solution is then made faintly alkaline by the addition of ammonia drop by drop, and the amorphous precipitate at first produced rendered crystalline by digestion at about 80° C. The precipitate is filtered off through a Gooch crucible, washed with dilute ammonia and ignited to manganese pyrophosphate.

This method for the estimation of manganese, suggested by Gooch and Austin[1], was adopted because the presence of iodide rendered the ordinary method, depending on the oxidation of the manganese to the manganic condition inconvenient. The results obtained are slightly high, but the errors are no greater than those attending the use of other methods, and they are not due to the presence of iron. When metals, such as calcium and magnesium, are present, the manganese should be precipitated as sulphide, redissolved in acid and reprecipitated as above. Nickel, cobalt and zinc do not interfere, on account of the solubility of their phosphates in ammonia.

For some reason, probably the carrying down of occluded alkaline salt, the ignition of the iron precipitate to ferric oxide is not feasible. In the discussion of the paper it was pointed out that a precipitate of iron, which could be ignited and weighed as ferric oxide, could be produced by redissolving the first precipitate and reprecipitating with ammonia.

Graphite in Madagascar

The flake-graphite deposits of Madagascar are of increasing interest, although none has yet been exported to the United States. According to *Daily Consular and Trade Reports,* Jan. 29, 1913, in 1909 the Madagascar exports were 200 metric tons; in 1910, 554 metric tons; 1911, 1281 tons; and in the first half of 1912, 1121 tons. On Dec. 31, 1911, only 200 claims were located, as against almost 400 on July 1, 1912.

The veins are found in decomposed quartzite and rotten feldspar, and extend nearly the whole length of the island, beginning a little to the south of the Mountain d'Ambre in the north and extending to Ambalavao in the south. The deposits being worked at present, however, are in the central plateau and on the east coast, principally in the environs of Tananarive, Mamjakandriana, Vatomandry, Andeveranto, Maevatanana, Betafo, Antsirabe, Ambositra, Fianarantsoa, Fort Carnot and Ambalavoa, extending about 250 miles.

The Madagascar graphite may be easily separated from the débris by simply washing it with the hands and, if the work is carefully done, may be concentrated up to 80 or 85%. The graphite thus far produced, however, has averaged from 70 to 80%, due to the fact that it has been washed almost wholly by natives with pans or sluices, the latter method giving the better results. By the use of machinery it is estimated that the concentrate may be brought up to 95 or 98%. As the decomposed quartzite and rotten schists retain moisture, only machinery suitable for handling such materials should be employed. Only three of the large producers of graphite have as yet installed machinery at their plants. These are the Maison Suberbie and the Syndicat Lyonnais, at Tananarive, and Arton & Allemand, at Mamjakandriana, with European headquarters at Antwerp.

While several European houses have representatives in the field, there are a number of producers not contracted with far ahead, from whom American firms might buy. The present price of Madagascar graphite varies from $38.60 to $135 per ton, f.o.b., according to the percentage of carbon and size of the flakes. Graphite averaging 80% carbon sells for $67.55 to $77.20, and that averaging 88 to 90% for $130.28. The freight per metric ton on graphite, as quoted by the Messageries Maritimes Steamship Co., is $17 from Tamatave to New York, and $20 from Vatomandry and Mananjary, the two southern ports from which graphite is shipped.

[1]Zeit. Anorg. Chem., 1898, page 330.

Opl Acid Towers

The acid plant at Hruschau, Austria, where the Opl towers were first put into use, is gradually scrapping its chamber plant, and replacing it by towers, as about double production can be obtained on the same ground area (*Chem. Trade Journ.*, Jan. 25, 1913). In a plant for the production of 18 tons of 142° Tw. acid per day, six packed towers are used, the first acting as Glovers, the last as Gay-Lussacs. The last towers produce an acid rich in nitric, which runs down the Glover with the total production, the acid running off being 142° Tw., and practically free from niter.

A coke chest behind the sixth tower retains the uncondensed acid fumes, the exit gases carrying from 0.4 to 0.65 gram SO_3 per cu.ft. For an 18-ton plant, a content of 21,180 cu.ft. is needed, i.e., the production is 1.87 lb. H_2SO_4 (142° Tw.) per cu.ft., or 2.04 cu.ft. of tower are required per pound of sulphur per 24 hr. A fan at the end of the system produces the necessary draft.

The advantages of the Opl are said to be : (1) Lower initial cost; (2) less ground space; (3) easier supervision; total production at 142° Tw. even with mechanical roasters. The entire process is controlled by an operator on a platform who constantly takes samples of the circulating acids from a receiver in front of him, and by the results, moves the valves controlling the water sprays and acid pumps.

Australian Radium Production in 1912

The Radium Hill Co.'s operations in 1912 resulted in the production of 2½ mg. of pure bromide, but it is said (*Min. Journ.*, Jan. 25, 1913) that 350 mg. more are in the laboratory in various stages of purification. There have been 93 tons of concentrates treated, about 3⅜ mg. of radium being extracted per ton of concentrates. The treatment costs are said to be about £19½ per ton. It appears that about five hundredweight of uranium oxide can also be produced each month.

A discovery of radium ores is reported by Clement Wragge, in the Mudgee district of New South Wales. No commercial development has yet been made here. The shareholders of the Mount Paynter Radium Extraction Co. are awaiting the results of official inspection before deciding on any course of action.

Continuous Decantation of Slime

By Herbert A. Megraw

SYNOPSIS—A development of the old slime decantation system of cyanidation whereby the process is continuous through thickening machines. The flow of solution is opposite to the direction of pulp movement and precipitation is accomplished at any desired point. The solution is passed over two or more different pulps before being precipitated in order to concentrate the metal in small solution volume. Water is added at the logical point; the end of the treatment system.

The advent of a new process is not regarded with excitement in the metallurgical world. Too many of them have appeared, led a struggling existence for a few months, or longer in some cases, and then disappeared without leaving many ripples in the places where they existed. Development of existing and proved processes, however, is regarded with interest, and as each step in advance proves its worth it is incorporated into the system of approved and satisfactory methods.

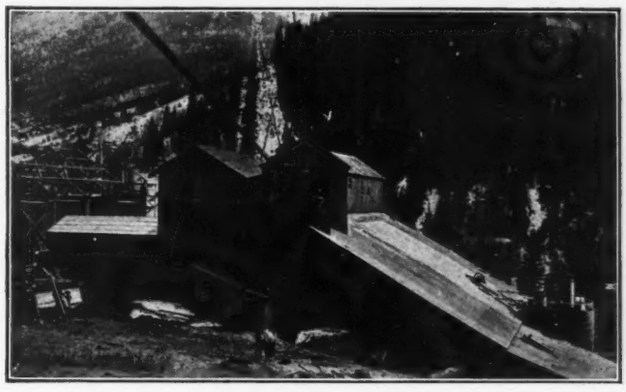
In the days when the decantation method of treating slime was the only one known, operators made serious efforts to improve it, particularly to find some way of avoiding the losses which occurred in discharging residues containing moisture charged with both cyanide and valuable metal in dissolved form. The necessity for improvement brought forth the slime filters, and for a long time experiments in decantation were discontinued. After many years of filtering, however, the suspicion remains that the decantation process might be improved so as to compete with filtration, the cost of operation and maintenance of existing filtering apparatus going far toward strengthening that suspicion. It may be said that the cost of slime filtration varies from 10c. to maximum figures which would be regarded with suspicion were I to mention them. Including cost of operation, maintenance and loss in dissolved metal, the minimum figure above mentioned is extremely low and I doubt whether there are any number of plants in existence attaining it. It will be seen that there is, then, an opportunity for improvement, for if any procedure can sucessfully reduce these costs or losses, or even equal them without the use of complicated and expensive machinery, it will stand a good chance for approval and success.

Proposed System of Continuous Decantation

Lately some progress has been made toward developing a process of continuous decantation, which is nothing new, but a development of the methods used before the filters came into use. In the old intermittent decantation process the slime after being agitated with a quantity of solution was allowed to settle, the solution decanted off and a new bath of solution put on. This was in turn agitated, allowed to settle and again decanted, the process being carried on as many times as was thought necessary. The efficiency of fresh solution washes was recognized, particularly when this solution was barren or freshly made up or regenerated, but the difficulty with this system was the enormous quantities of solution to be handled in addition to the impossibility of reducing the moisture content of the final pulp to such a point that too much dissolved metal and valuable cyanide should not be thrown away. This new development attempts to accomplish a solution of both difficulties by means of a continuous-decantation and thickening process using solutions flowing opposite to the course of the pulp. The fact that this method has seemed feasible to a number of competent metallurgists and is actually in operation in a number of instances makes it worthy of attention and in this paper two such plants will be described.

Ores Milled in Cyanide Solution

The plants in question are the mills of the Ophir Gold Mines, Milling & Power Co., at Ophir, San Miguel County, Colorado, and of the Blue Flag Gold Mining Co., in the Cripple Creek district. Both are of recent construction, and while operations have not been carried on long enough to provide satisfactory details of cost and maintenance, the metallurgy has shown sufficient promise of success to warrant consideration.



Ophir Mill, Ophir, Colo., Using Continuous Decantation

The Ophir mill crushes ore with stamps, the installation including 20 of 850 lb. each with 6-in. drop and 104 drops per min. From the stamps the pulp goes to a Dorr classifier, where the slime is passed to a Dorr thickener and the sand reground in a Hardinge mill, from which it is pumped back to the classifier, the circuit being closed and only solids of sufficient fineness reaching the thickener.

A point of interest is that the overflow solution from the first thickener is the only one precipitated. It is passed through a clarifier and precipitated with zinc dust. The thickened pulp is passed to two agitation tanks of the Dorr type, through which it passes in series and where it is calculated that the extraction is practically completed. Leaving the agitators, the pulp is delivered to the first of a series of four thickeners, through which it passes with successive dilutions until it is finally discharged from the last one, washed practically free of gold in solution.

The overflow solution from the first of these thickeners is returned to the mill solution tank, where it is used

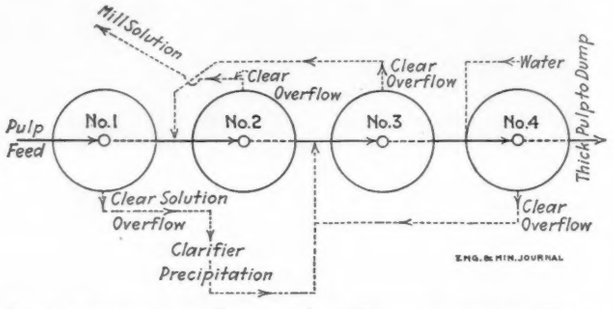
Note—This is the eighth of a series of articles by Mr. Megraw on American cyanide practice. Previous articles appeared Nov. 2, Nov. 23, Dec. 14, Dec. 21, Dec. 28, 1912; Jan. 4 and Feb. 8, 1913.

in milling and classifying, the result being a concentrated solution for precipitation. The barren solution from precipitation goes to dilute the inflow into the second thickener, the overflow from which goes back into the first. The accompanying flow sheet shows the movement of pulp and solution throughout the mill. It will be noted that water is taken into circulation at the end of the washing period, the logical point of entry for it, and practically replaces the solution which comes with the solids to that point.

Solutions Progress Contrary to Pulp

It will also be noticed that the progress of solutions is contrary to the direction of pulp flow, the solutions being constantly enriched. The figures given in the flow sheet are based on ore carrying $5 in gold and the contents of solutions are given in pounds of KCN and lime. The calculations of thickening are based on withdrawing a pulp from each thickener which consists of half solids and half solution. This is accomplished in practice, in fact a slightly thicker pulp can be obtained, thus increasing the efficiency of the process. It has been in operation only a short time but the results obtained have been in complete accordance with the figures shown. It will be seen that the installation is simple and inexpensive, may be operated by a minimum amount of labor and accomplishes a washing of pulp and removal of dissolved metals that is, to say the least, comparable with good filtration work.

The lime in this mill is added at the bins and goes through the circulation with the pulp. The consumption amounts to about 0.9 lb. per ton of ore. The value of the process depends a great deal on using solutions of low cyanide content and the existence of a plentiful water supply, which conditions are satisfactorily met in this case. The flow sheet shows all the details of the process and apparatus and no further explanation is needed.



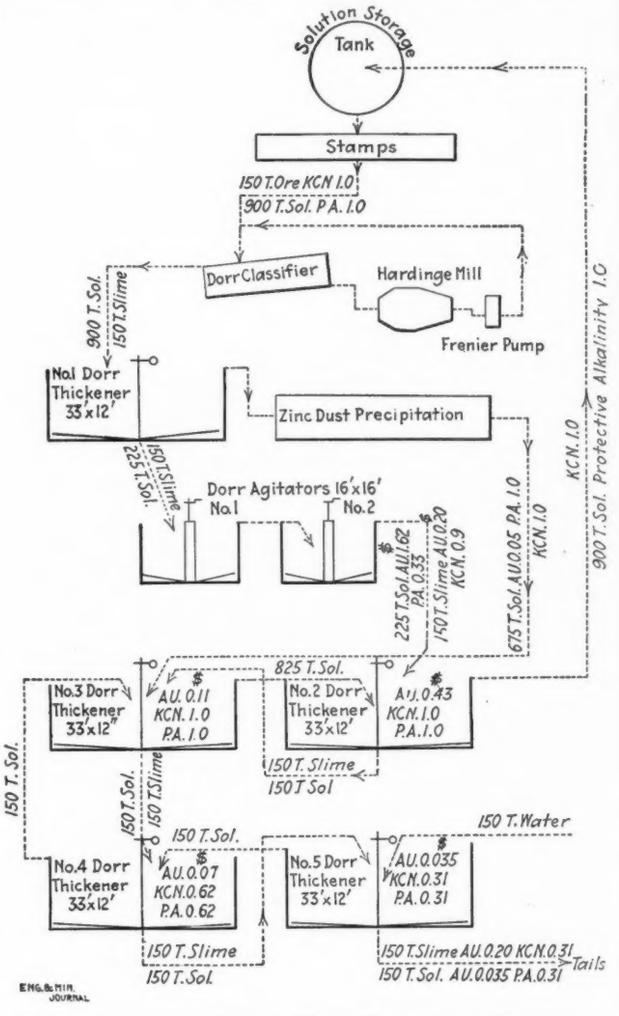
Arrangement of Continuous Thickeners at Blue Flag Mill, Cripple Creek, Colo.

The Cripple Creek Installation

The Blue Flag mill is situated between Cripple Creek and Victor in Colorado. The ore averages between $5 and $6 and is to a great extent from the dumps. The coarse ore is dumped on to a steel conveying and picking belt where a portion of the barren rock is removed. From the picking belt it is passed through a 12x18-in. Dodge crusher and through a Symons disk crusher from which it emerges reduced to about ⅜-in. cubes. The finely crushed ore is then delivered to a special form of chilean mill which consists of a concave die ring 7 ft. in diameter, over which convex rollers pass. The rollers are small, weighing only 700 to 800 lb. each. The mill makes 36 r.p.m. and grinds the ore, in cyanide solution of 1½ lb. per ton strength, through a 30-mesh screen. Solution is used at the rate of about five to one.

The pulp as it comes from the mills is delivered to the series of agitating tanks through which it passes continuously. These tanks are 14 ft. diameter and 16 ft. deep, having cone bottoms at an angle of 55°. The agitation is pneumatic, elevating the pulp through a central tube.

This point in the process is open to criticism, as the pulp from the mills is in too coarse condition for economical agitation, to say nothing of the metallurgy of it. If it is true that finer crushing is not necessary, then it would seem reasonable to separate the coarse portion of the solids and treat it separately by some more economical means. The pulp undergoing agitation has the following approximate grading analysis: On 30 mesh, 0 to 0.5%; on 40 mesh, 4 to 9%; on 60 mesh, 22 to 24%; on 80 mesh, 35 to 36%; on 120 mesh, 58 to 60% and through 120 mesh, 40 to 42%. The grading statement is cumulative. Pulp of this class requires excessive power to keep it in circulation.



Flow Sheet of Ophir Mill, San Juan District, Colo.

Washing in Continuous Thickeners

The pulp is in circulation through the agitation tanks for about nine hours and the extraction in them amounts to about 70%. In considering the extraction results it

must be remembered that this is on the refractory ore of the Cripple Creek district. The cyanide consumed in the process is about 0.35 lb. of which 0.15 lb. is mechanical loss. Lime is added to the ore bins and progresses with the pulp, the consumption being about 2½ lb. per ton milled.

The pulp from the agitators is taken to a series of four thickeners and is washed through them after the manner described in the Ophir mill. The accompanying diagram shows the flow of pulp and solutions through them. In the case of the Blue Flag mill, also, it has been found possible to secure a thickened pulp containing less than 50% moisture. In this instance, also, it has been found that the calculations, based on 50% thickening, are borne out in practice.

Other Combinations Possible

It should be remembered that this development is not recommended to cure all the ills that cyaniders are heir to, but is a progression along conservative lines and one that should eventually lead to a fixed system available in cases where the character of the ore will bear such treatment and where other local conditions are favorable. It is a system which, while not yet perfected, will be well worth following. It is easy to see that other combinations are possible, such as using a greater number of thickeners, of this type or any other satisfactory one, and by precipitating two or more different solutions. The two installations mentioned are not by any means the only ones using it. They may not even be the ones where it is most advanced, the idea in presenting the matter being principally to draw attention to the fact that there is a system in course of development which may possibly lead to decided economies in the cases of ores to which it is applicable.

California Oil in December

The net production of petroleum in all California fields in December was 7,201,496 bbl., an increase over November of 35,304 bbl. The daily average production in December (31 days) was 232,418 bbl., and in November (30 days) 239,206 bbl. Field consumption in December was 421,798, making the total gross production 7,623,294 bbl. The December shipments totaled 6,780,443 bbl., a decrease of 117,166 from November. Losses amounted to 158,651 bbl., making the total outgo for December 6,939,094. Stocks on hand at the end of December totaled 47,552,392 bbl. Field operation and development in December showed 40 new rigs, 70 completed wells, 5832 producing wells active, 902 wells capable of producing but idle, 348 wells actively drilling, 363 wells on which drilling was suspended, 18 wells abandoned.

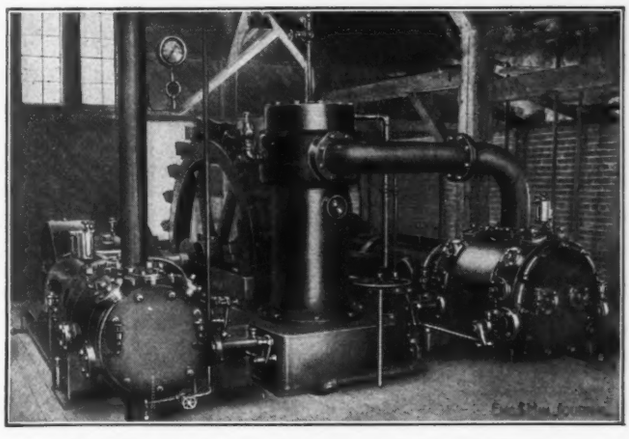
CALIFORNIA OIL PRODUCTION BY FIELDS

Districts	Bbl.
Fresno County—	
Coalinga	1,574,205
Kern County—	
Midway	2,236,567
Kern River	843,064
McKittrick-Belridge	547,164
Maricopa	385,488
Lost Hills	133,327
Total Kern County	4,145,610
Santa Barbara County—	
Santa Maria, Lompoc, Cat Cañon	406,353
Summerland	4,350
Total Santa Barbara County	410,703
Southern Fields—	
Olinda, Brea, Puente	509,916
Salt Lake-Sherman	216,542
Coyotes-La Habra	169,278
Ventura County	68,406
Whittier	64,954
Los Angeles	31,842
Newhall	10,040
Total Southern Fields	1,070,978
Total All Fields	7,201,496

New Type of Compressor Intercooler

At the Blue Bell mine, on Kootenay Lake, B. C., a new Sullivan compressor with interesting features has been recently installed and is described by Chester Mott in *Mine and Quarry*. The machine is of the cross-compound type, class WS-2, with a capacity of 1340 cu.ft. of free air per minute which it delivers at 100-lb. pressure. It is driven at 210 r.p.m. by a 9-ft. impulse waterwheel, furnished by the Nelson (B. C.) Iron Works, pressed directly on the crankshaft of the machine. In the accompanying photograph the hood which confines the water has been removed in order to show the wheel.

The compressor is equipped with low-pressure air cylinder 21 in. in diameter, high-pressure cylinder 12½ in.,



Water-driven Compressor with Vertical Intercooler

and with a common stroke of 16 in.; a total closure unloading valve on the low-pressure cylinder and bath lubrication for the main bearings, eccentrics, crossheads and other principal working parts render it practically automatic, so that little or no attention is required. The air valve-gear consists of semi-rotary or Corliss intake valves operated through reach rods by eccentrics on the compressor shaft; and of automatic poppet discharge valves, which are removable with their seats for inspection or regrinding. The inlet ducts for the incoming air are arranged so that they pass outside of the cylinder water jacket; enabling the air to reach the interior of the cylinders at nearly atmospheric temperature. After it leaves the intake cylinder and before it enters the discharge cylinder, the air passes through a large vertical intercooler. This intercooler contains aluminum tubes, set close together and staggered, and surrounded with a steel jacket. The air is thus forced to come in intimate contact with the cold surfaces of the tubes in passing from one end of the intercooler to the other, effectually reducing the temperature of the partially compressed air before introduction of the high-pressure cylinder and giving a high degree of efficiency to the intercooler.

Statement Respecting A. I. M. E. Nominations

The following communications have been received, referring to A. I. M. E. nominations for the coming election:

To the Editor,

ENGINEERING AND MINING JOURNAL:

The accompanying statement from the Committee on Nominations of the American Institute of Mining Engineers has been placed in my hands with the request to give it prompt circulation. I do so at once, believing the act to be simply one of justice to a committee which gave to the best of their judgment, laborious service to the Institute. Members may not support their recommendations, but all who know of their efforts must realize that rarely in the history of the Institute has service been so freely given without regard to time or personal expense.

J. F. KEMP.

New York, Feb. 9, 1913.

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To J. F. Kemp,

President, American Institute of Mining Engineers:

A recent circular to the members of the American Institute of Mining Engineers, by Karl Eilers and Charles Kirchhoff, presenting the name of Doctor Struthers for secretary of the Institute, demands comment from the nominating committee, the decisions of which are severely criticized.

Considered of itself, it is the privilege of any member to present candidates in opposition to a ticket named by an officially appointed nominating committee. In fact, it is an evidence of interest in the affairs of the Institute, which is most welcome. When, however, the nominators go out of their way to attack the methods of the committee, and by implication at least, to suggest that they were dishonorable, it is proper to explain to the members the attitude of the committee. A better understanding of its decision may perhaps be given by clearly stating just what are the duties of the nominating committee.

It acted upon the theory that its duties were something more than clerical. It considered itself to be a body, widely acquainted, without axes to grind, appointed by the president of the Institute to recommend candidates who, if elected, shall fitly represent the best ideals of the profession. It sought, however, the widest possible consultation, personal and by letter, with the members, requesting expressions of interest. The many letters received in response were of great assistance. By its request, however, the committee did not bind itself to accept advice from those whose information was more limited than theirs.

In making final decision, the nominating committee would have been recreant to duty had it failed to give careful thought to recent events in the affairs of the Institute, and to all the facts and arguments brought to its attention through personal discussions and letters regarding the qualifications of gentlemen suggested for nomination. The American Institute of Mining Engineers is a body so widely scattered that not 10% of its members are so situated that they are familiar with its details, even should they so desire. The committee, therefore, considered itself as a trustee for its members, bound in all good faith to judge the candidates for office in the light of their past history and by the strictest standards.

Acting thus, its refusal of a renomination of Doctor Struthers was because of its belief that such a nomination would mean a vote of approval by it of the past practices of having salaried officers of the Institute conduct its excursions on a speculative basis of profit from the members. A further reason was that many members had been indifferent and dissatisfied for years, feeling scant consideration had been shown them, and that the welfare of the Institute seems to demand a change in order to renew interest and harmony.

The committee has made no threat that "if Doctor Struthers should be named by the committee or anybody else, certain alleged vouchers and documents, damaging to the reputation of the late management of the Institute, would be furnished in one or more technical journals to which they have already been communicated."

The committee had and has no intention to publish any vouchers or documents. It is hardly its province to do more now than to attempt to make their viewpoint clear to members.

The committee has been criticized because of failure to renominate all the councillors and vice-presidents of the council whose terms had not expired. Its nominations were made with full consideration of the revised articles of incorporation, and the proposed new constitution, giving geographical distribution to the directors, in the hope to avoid the former charge of undue local control, trusting that the scattered membership may feel that their wishes are consulted, and that through their representatives they may gain closer acquaintance and greater interest in the affairs of the Institute.

Within the membership there are many men who would worthily and efficiently fill any office in the gift of the Institute. Among these surely all those named by your committee should be included. They are worthy the support of the membership at large.

PHILIP N. MOORE, *Chairman,*
Nominating Committee.

St Louis, Mo., Feb. 6, 1913.

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The Society and the Institute

Plans for a union of the Mining and Metallurgical Society of America and the American Institute of Mining Engineers have been under consideration for a long time. Several months ago both organizations united in appointing a committee to formulate a plan, the representatives of the Institute being James Douglas, A. R. Ledoux, James F. Kemp, W. L. Saunders and Charles F. Rand; and of the Society, J. Parke Channing, J. R. Finlay, H. M. Chance, H. S. Munroe, and W. R. Ingalls. This committee reported the following plan:

(1) The Society to become the Mining and Metallurgical Society of the A. I. M. E., the Society preserving its integrity and organization.

(2) The Society to preserve in its insignia the letters M. M. S. A.

(3) The Society to continue its studies of professional and professional-political questions through committees and otherwise as at present.

(4) The Society to make membership in the Institute a qualification for membership in itself; to abolish the provisions of its constitution and by-laws pertaining to initia-

tion fee, life membership and honorary members; to suspend temporarily its by-law relative to the election of members and permit its executive committee, in conference with the membership committee of the Institute, to elect out of the Institute members meeting the qualifications of the Society, their election to be consummated by the executive committee of the Society, this suspension of the membership by-law of the Society to last for only three months after the date of the union of the Society and the Institute, or for such additional time as the council of the Society may fix.

(5) The Society to urge its members who are not members of the Institute to become such. Such members becoming members of the Institute to be exempt from the initiation fee of the Institute. Resignation of membership in the Society with preservation of membership in the Institute to be permitted.

(6) The Society to amend its by-laws so as to make its annual dues $20 per member, this to cover the dues of its members as members of the Institute. The Society to pay into the treasury of the Institute $15 per member per year, except as hereinafter stipulated. The Society to retain in its treasury such fund as will be necessary for the award of its annual medal; to accumulate, maintain and retain an additional surplus of $2500; the Society to turn over to the Institute all annual surplus over actual expenses and the accumulation and maintenance of the reserves herein specified.

(7) The Society to incorporate in its by-laws a provision that $10 shall be deducted from the annual due of members who are, or may become, life members of the Institute; the Society to pay into the treasury of the Institute only $5 per annum on account of such members; the Society not to pay anything into the treasury of the Institute on account of members elected during the last three months of a year as dues for that year, or on account of members whose dues to the Institute have already been paid.

(8) The Society to manage its own affairs, except in the matter of publishing its proceedings, which publication shall be done by the Institute. The Institute to publish in its bulletin all of the proceedings of the Society as communicated by the officers thereof, the form of such publication to be satisfactory to the council of the Society. The Institute to have the right to republish in its transactions such part of the proceedings of the Society as the governing body of the Institute may desire so to republish. All publications of the Institute to be sent to all members of the Society.

(9) The Institute to be the representative organization in all public affairs not involving the action or opinion of the Society; the Society not to be represented in such affairs, except by request of the Institute.

(10) The Society and the Institute to avoid duplication of committee work, i.e., if one has appointed any committee, the other shall not appoint a similar committee (except as to internal affairs).

(11) The Society and Institute to adjust differences that may arise respecting representation, committee work and meetings of local sections by conference between their respective governing bodies.

(12) The Institute and the Society each to make the changes in its constitution and by-laws that may be necessary to carry out the terms of this agreement.

The above plan has been adopted by the councils of both organizations and now awaits further action.

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The Western Electric Co. in 1912

The Western Electric Co. is of interest, being one of the largest manufacturing concerns of the United States and one of the largest consumers of copper. It informs us that its sales in 1912 will figure between 71 and 72 millions, which is slightly more than in 1906, the previous largest year in the company's business. The increase has been in American sales outside of the Bell System, which have increased about 100% over 1906, and in European sales.

The company is now selling to upward of 30,000 customers in the United States alone. The board of directors has established two additional vice-presidents in the company's organization, and has appointed to these newly created positions Gerard Swope, general sales manager, and A. L. Salt, general purchasing agent, the latter being particularly well known in the metal trade as a remarkably astute buyer.

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The Wisner Case

Judge Julian Mack, in the U. S. District Court, on Feb. 8, discharged the jury in the trial of Archie L. Wisner and John J. Meyers, after the foreman, William H. Harned, had for the fifth time reported the inability of himself and his associates to bring in a verdict. The jury had been out almost 48 hours, and it is known that during all that time only one member stood out against the conviction of the two defendants. This one member, it is also known, was willing to convict Wisner, but refused to cast his vote against Meyers.

In discharging the jury, Judge Mack thanked the members perfunctorily and then added: "I never, in all my experience, saw a clearer case of conviction, or damaging evidence better presented. In my opinion it is incomprehensible how any man on this jury could have stood out for acquittal."

After the judge had left the bench he was closeted for some time with the foreman of the jury and George L. Dann, another juror, who presented the court with a written statement concerning the obduracy of Juryman John W. Stevens, a builder, of 78 West Ninety-fourth St. In this statement, which Dann later discussed, according to the *Sun*, the writer relates how Stevens refused to listen to the arguments of the other jurymen, saying that most of the witnesses lied. As the hours dragged on and Stevens persisted in his attitude, Dann said that the sessions became acrimonious and that the feeling between Stevens and one of the jurymen in particular grew so bitter than Stevens finally threatened to kill the latter if he opened his mouth about the case to him, Stevens.

U. S. Attorney Wise, in moving that the bail of the defendants be raised to $25,000 each, said that the government intends to retry Meyers and Wisner as soon as possible. "And they know, your Honor, as well as we do, what the outcome of that retrial will be," said Mr. Wise.

The attorneys for the defense protested vigorously against the raising of the bail bonds. Judge Mack fixed Meyers' bail at $12,500 and Wisner's at $4000, but paroled the two men in custody of their counsel until Feb. 10, when the matter of the bonds will be straightened out. The retrial will be started as soon as the California witnesses can be brought back to New York.

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World's Petroleum Output in 1912

The world's production of petroleum still continues to increase, according to the *Petroleum Review*, Jan. 25, 1913, which gives the accompanying table (our own figures being used, however, for the United States):

WORLD'S PETROLEUM OUTPUT

Country	1911 Bbl.	1912 Bbl.
United States	218,400,000	219,000,000
Russia	62,000,000	63,000,000
Mexico	9,500,000	16,000,000
Dutch Indies	11,600,000	13,000,000
Roumania	10,800,000	12,500,000
Galicia	9,000,000	8,000,000
British India	7,200,000	7,500,000
Other countries	7,000,000	10,000,000
Total	335,500,000	349,000,000

NEW PUBLICATIONS

COAL MINING IN ARKANSAS. Part I. By A. A. Steel. Pp. 632, illus. Geological Survey of Arkansas, Little Rock.

BUILDING STONES AND CLAY PRODUCTS. By Heinrich Ries. 6x9¼, pp. 415, illus.; $3. John Wiley & Sons, New York.

TRAITE DE METALLOGRAPHIE. By Felix Robin. 6½x9¾, pp. 464, illus.; 30 francs. A. Hermann et Fils, Paris, France.

THE THEORY OF ENGINEERING DRAWING. By Alphonse A. Adler. 6x9, pp. 312, illus.; $2. D. Van Nostrand Co., New York.

ELEKTROCHEMISCHE INDUSTRIE FRANKREICHS. By R. Pitaval. 7x9¾, pp. 140, illus.; 9 marks. Wilhelm Knapp, Halle a. S., Germany.

CAMBRIAN BRACHIOPODA. By Charles D. Walcott. 9x11½, pp. 872, illus.; 104 plates in separate volume. Monograph LI, U. S. Geological Survey, Washington, D. C.

MINERALOGY OF THE RARER METALS. By Edward Cahen and William Ord Wootton. 4¼x6½; pp. 209; leather; $2.50. J. B. Lippincott Co., Philadelphia, Penn.

REPORT OF THE SECRETARY FOR MINES OF TASMANIA FOR THE YEAR ENDING DECEMBER 31, 1911. Pp. 121. John Vail, Government Printer, Hobart, Tasmania.

PLIOCENE AND PLEISTOCENE FORAMINIFERA FROM SOUTHERN CALIFORNIA. By Rufus Mather Bagg. Pp. 153, illus. Bull. 513, U. S. Geological Survey, Washington, D. C.

LA FABRICATION DU COKE ET LES SOUS-PRODUCT DE LA DISTILLATION DE LA HOUILLE. By Adrien Say. 6½x10, pp. 243, illus.; paper; 16.50 francs. H. Dunod et E. Pinat, Paris.

SANDSTONES OF THE WISCONSIN COAST OF LAKE SUPERIOR. By Frederick Turville Thwaites. Pp. 117, illus. Bull. 25, Wisconsin Geological and Natural History Survey, Madison.

AN INTENSIVE STUDY OF THE WATER RESOURCES OF A PART OF OWENS VALLEY, CALIFORNIA. Charles A. Lee. Pp. 135, illus. Water-Supply Paper 294, U. S. Geological Survey, Washington, D. C.

INDEX TO THE STRATIGRAPHY OF NORTH AMERICA. By Bailey Willis. Accompanied by a geologic map of North America. 9x11½, pp. 894, illus. Professional Paper 71, U. S. Geological Survey, Washington.

REPORT OF THE UTILIZATION OF PEAT FUEL FOR THE PRODUCTION OF POWER. By B. F. Haanel, B. Sc. Pp. 145. Illustrated, Mines Branch, Canadian Department of Mines. Government Printing Bureau, Ottawa, 1912.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1911. With Subject Index. By John M. Nickles. Pp. 162. Bull. 524, U. S. Geological Survey, Washington, D. C.

WATER RESOURCES OF CALIFORNIA. Part II, Stream Measurements in San Joaquin River Basin. By H. D. McGlashan and H. J. Dean. Pp. 439, illus. Water-Supply Paper 299, U. S. Geological Survey, Washington, D. C.

COMPARATIVE FUEL VALUES OF GASOLINE AND DENATURED ALCOHOL IN INTERNAL-COMBUSTION ENGINES. By R. M. Strong and Lauson Stone. Pp. 239, illus. Bull. 43, U. S. Bureau of Mines, Washington, D. C.

STATISTICS OF THE AMERICAN AND FOREIGN IRON TRADES. Part I of the Annual Statistical Report for 1911 of the American Iron and Steel Association. 6x9½, pp.63, half leather. James M. Swank, General Manager, Philadelphia, Penn.

A RECONNAISSANCE REPORT ON THE GEOLOGY OF THE OIL AND GAS FIELDS OF WICHITA AND CLAY COUNTIES, TEXAS. By J. A. Udden and Drury McN. Phillips, of the Bureau of Economic Geology and Technology. Pp. 308, illus. Bull. 246, University of Texas, Austin.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1910. Part IX, Colorado River Basin. By W. B. Freeman, E. C. La Rue and H. D. Padgett. Pp. 233, illus. Water-Supply Paper 289; Part X, The Great Basin. By E. C. La Rue, F. F. Henshaw and E. A. Porter. Pp. 264, illus. Water-Supply Paper 290; Part IV, St. Lawrence River Basin. By C. C. Covert and R. H. Bolster. Pp. 98, illus. Water-Supply Paper 304; U. S. Geological Survey, Washington, D. C.

CHEMICAL ANALYSIS OF LEAD AND ITS COMPOUNDS. By J. A. Schaeffer and B. S. White. 5½x7½; pp. 63. Picher Lead Co., New York.

This book covers the following topics: The analysis of lead ores; of sublimed white lead; of sublimed blue lead; of red lead and orange mineral; of flake red lead; of litharge; of basic carbonate of lead; of pig lead; the determination of the apparent density of pigments; electrolytic deposition of lead; the iodometric determination of antimony and arsenic in lead-antimony alloys. The book is a compilation of what appear to be the most approved methods as used by various commercial laboratories. It is a chemical "cook book," there is no discussion of theory, the directions are given and the chemist may figure out reasons for himself. In many respects this seems the best method for a book intended for commercial laboratories, and we recommend it to those engaged in the lead trade.

CYANIDE PRACTICE IN MEXICO. By Ferdinand McCann. 6x9¼, pp. 199, illus.; $2. Mining and Scientific Press, San Francisco, Calif.

This book contains detailed descriptions of the practice in the principal cyanide mills in Mexico. In many cases flow sheets are given adding greatly to the clearness of the descriptions. Data on chemical consumption and costs, which are given for each mill, make comparisons possible. Two chapters are devoted to a general consideration of precipitation, the cleanup and melting and refining methods. Inasmuch as the practice in Mexico deals essentially with the cyanidation of silver ores, the present volume should prove of especial value as indicating the present status of that particular application of the cyanide process.

BOOK OF PIPE STANDARDS. 4x6½; pp. 559; leather; $2. National Tube Co., Pittsburgh, Penn.

This is a pipe handbook of much value to engineers and all users of tubular products. It contains 559 pages, but being printed on Canterbury bible paper is only five-eighths of an inch thick and will readily fit the pocket. The contents present a wild range of interesting and useful technical data relating to the numerous applications of tubular products. There are, besides a series of technical articles describing production methods and tests, numerous tables giving weights, dimensions, threads per inch, test pressure, specifications and other engineering data that is often required in connection with pipe instaliations. Chapters are supplied relating to tubular beams, safety factors, safe working stresses, etc.; the properties of air, gas, steam and water; and tables of area and weight for tubes and pipes; size increments, etc. A glossary of terms used in the pipe and fittings trade is given in the back of the book and will be welcomed by many users who have been puzzled by trade terms, not readily interpreted by analogy. The 1913 book of standards is a valuable reference book that reflects credit upon its publishers.

A TEXT-BOOK OF RAND METALLURGICAL PRACTICE, VOL. II. By C. O. Schmitt. 6½x9; pp. 438, illus.; half leather, $6.50. Charles Griffin & Co., Ltd., London; J. B. Lippincott Co., Philadelphia.

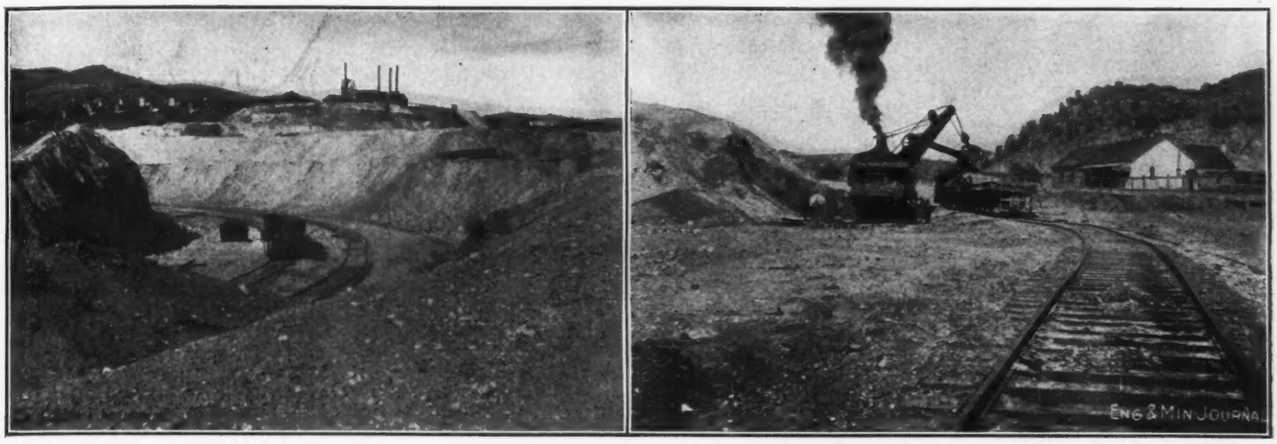
The second volume of this treatise covers about the same field as the first volume, but goes more into the details of the methods and especially into thorough descriptions of the paraphernalia usually found in the gold mills of the Rand. The subject is divided into two sections, the first of which is entitled "The Design and Construction of Reduction Plants," the second, "The Transport of Materials." The subjects are dealt with in the same manner as in the introductory volume, that is, the ideas of the authors are conveyed mainly through sketches, drawings and photographic reproductions with such description as may be necessary to elucidate the illustrations. The splitting of the subject matter, and the method of compiling the contributions of the several authors is open to criticism. It is poor editorial policy to treat of the same subjects in the two volumes and it is to be regretted that such a splendidly useful textbook should be thus marred. It is unfortunate that the reader should be compelled to refer to two volumes when he wants data that he naturally expects to find gathered into one chapter of a single volume.

IRON MAKING IN ALABAMA. By Dr. William Battle Phillips. Third edition. 6x10 in.; pp. 254; illustrated. Issued by the Geological Survey of Alabama; University of Alabama.

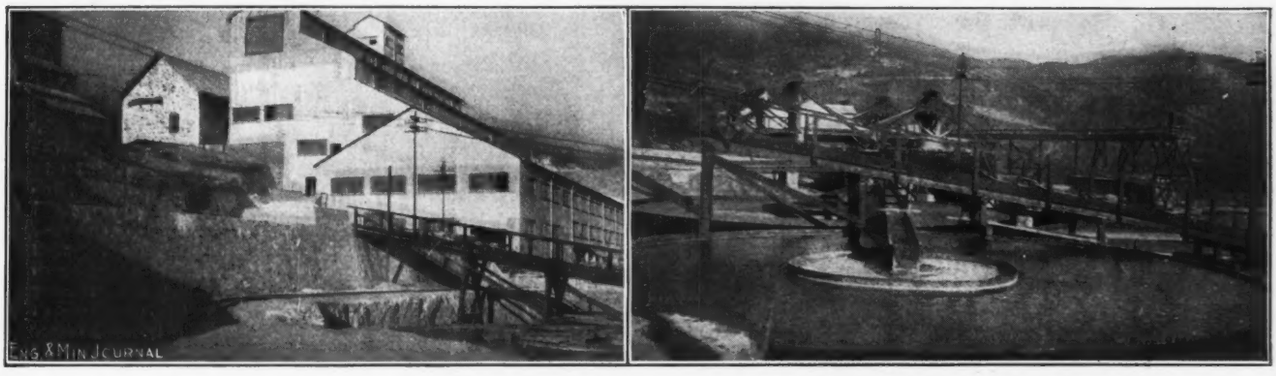
Doctor Phillips' admirable monograph on "Iron Making in Alabama" was so full and comprehensive that it has been a standard authority on this subject ever since it was first issued in 1896. Three years later, a second edition was published, but naturally since that time there have been many changes—more of them in financial conditions and economic methods than in mining and supplies of material. The great changes, metallurgically speaking, have been in the increased use of steel processes and in the introduction of the by-product oven in coke making. The present volume has been revised and brought up to date by the author and there have been added to it a very complete chapter on "Steel Making in Alabama," by Frank H. Crockard, and shorter chapters on "Byproduct Coke Plants," by J. L. Haehnlen, and on "Coal Washing," by David Hancock. Supplements give lists of iron and steel works in the state and of iron mines as well as a bibliography; and there is a complete index.

Of course, the new plants and extensions of older ones since the report was first written required some changes in the book, but Doctor Phillips' original description and characterization of the ores of Alabama and of their treatment in the blast furnace was based on such full and careful observation that little change was required in this respect. The book is illustrated with a large number of halftones showing mine workings, mine outcrops, mills and other views of interest.

PHOTOGRAPHS FROM THE FIELD



STEAM SHOVELING AT CHINO COPPER CO., SANTA RITA, N. M.



THE CRUSHING DEPARTMENT AND DORR SLIME THICKENERS AT THE SANTA GERTRUDIS MILL, IN THE PACHUCA DISTRICT, MEXICO

A NATIVE SMELTING PLANT AT THE ANGAT IRON MINES, BULACAN, PHILIPPINES

CORRESPONDENCE AND DISCUSSION

The Shipment of Cyanide Precipitate

In the JOURNAL of Feb. 8, 1913, Mr. Megraw comments on the shipment of cyanide precipitate to smelters as being cheaper than home treatment, and advises other plants to investigate the matter. However, he seems to state the vital objection to it in the same paragraph, "the chance of loss due to difference in sampling."

I have seen this thing tried out where I knew that every effort was being made to give the shipper a square deal, and as a check, the shipper's material was treated by itself, as far as producing bullion and byproducts went. The bullion alone carried more metal than the assays showed in the original precipitate, while there was a whole string of metalliferous byproducts still to be heard from.

Of course the balance might be in favor of the shipper, I remember hearing that one of the difficulties of the old Seattle Smelting & Refining Co. was due to erroneous sampling on exceedingly high-grade material, giving the shippers more than was coming to them, but usually the sampler will err, although perhaps unconsciously, on his own side.

Considering the expense of tight coopering or bagging, freight, the danger of theft in transit, and errors in sampling and assaying, it seems that a plant shipping cyanide precipitate, silver sulphides, or like material, is taking a long chance.

K. T. WHEELER.

Pittsburgh, Penn., Feb. 10, 1913.

Centrifugal Pump for Molten Lead

In the JOURNAL of Jan. 11, 1913, p. 98, the following statement is made by Professor Hofman:

> **Another improvement, first used probably at Grasselli, Ind., is the removal of the lead from a kettle by a horizontal (this should be vertical, I think) centrifugal pump driven by an electric motor. This works beautifully; one important advantage of the Steitz siphon, invented in 1877, is the depth of a lead kettle is no longer limited to 40 in., so that a kettle can easily be made to hold 60 tons of refined lead.**

You will note that Professor Hofman says, "probably at Grasselli, Ind.," and I thought that perhaps it might be interesting to know where the centrifugal pump was first used for handling lead.

We formerly used the Roesing lead pump, and here let me say, I cribbed it straight from Professor Hofman's most excellent work, "The Metallurgy of Lead." The Roesing pump makes a large amount of dross, the smeltery was charging us a high rate for treating it, and then, too, the upkeep was high on the Roesing pump. I had been puzzling how to beat this combination for some time when the thought struck me one day, after reading an advertisement in the JOURNAL, how would a centrifugal pump work pumping lead? This was in August, 1905. I at once wrote to all the manufacturers of centrifugal pumps whose address I could find, asking them if they had ever used or heard of using a centrifugal pump in handling molten lead, and if so, would they give me some data on this use. They all replied that they knew nothing of a centrifugal pump being used for this work, and just one, a San Francisco firm, offered to make some experiments at our expense. We had everything at hand except the centrifugal pump, and I borrowed one from a near-by concentrator. This pump we rigged up in a pot of lead to run the same speed as for pumping water; it was a sight I will never forget, when the switch was thrown in that pump threw a 2-in. stream of lead clear over the pot and made a great scattering of the "Romans." At a reduced speed we have been using the centrifugal pump ever since and it gives great satisfaction. It has since been adopted by a number of plants, among them the Grasselli refinery mentioned above. (Cf. "Lead Refining by Electrolysis," Betts, pp. 316 and 320.)

While writing of this, I will mention another use to this which I have put a centrifugal pump. Four years ago I installed an all-iron vertical centrifugal to handle concentrated sulphuric acid from a storage tank to kettle tanks, a lift of about 25 ft. The same pump is still in use and gives perfect satisfaction. Have had no repairs or renewals except a new runner last winter, the old runner having been broken by using a chain wrench on the pulley when the acid was frozen in the pump.

While I feel sure I originated the idea of the use of the centrifugal pump for handling lead and bullion, I wish the greatest number to have the benefit of the idea, for I realize that I have cribbed a great deal, particularly from your own valuable publications.

JOHN F. MILLER.

Trail, B. C., Jan. 23, 1913.

A Microscopist in the Field

In the article "A Microscopist in the Field," by Walter E. Koch, in the JOURNAL of Jan. 18, 1913, he describes the detection of tiny specks of gold by means of the microscope in the residue left behind, after dissolving the crystallized salts obtained on evaporating water collected from a hot spring which burst forth in the vein of a certain gold mine in Mexico, from which he concludes that the gold must have been dissolved by the hot alkaline water, only traces of chlorides being present. I should like to ask the following question:

If the gold was dissolved by the hot alkaline water and was therefore in the form of some gold compound, how does Mr. Koch account for the presence of the tiny specks of metallic gold as revealed by his microscope? No mention is made that he fused or reduced any metallic compounds, and thereby changed them to the metallic state. I am of the opinion that the tiny gold specks were carried by the water in mechanical suspension, and probably passed through the filter paper into the filtrate, when filtering the water, previous to evaporation.

CARL HAMM.

Metcalf, Ariz., Jan. 23, 1913.

EDITORIALS

The Institute Amendments

Referring to our editorial advice last week to members of the Institute to vote for the pending amendments to the constitution and by-laws as the really important thing in the present juncture, some members have written, asking if we advise voting for *all* of these amendments.

This inquiry in itself exhibits the proper spirit of interest. In our previous article we did not go into this matter, for the reason that many members having already expressed such confusion, resulting from the mass of circulars, proxies, ballots, and controversial literature with which they have lately been showered, it did not seem wise to divert attention from the main points that ought to be carried.

These main points are (1) the change in the order of business at the annual meeting, and (2) the adoption of the proposed new constitution and by-laws as submitted by the special committee of the Institute. These are the first two questions on the form of proxy running to Doctor Douglas and Doctor Ledoux. We urge all members of the Institute to vote "adopted" on both of these questions.

As to the remainder of the questions, we do not think it matters very much whether they are carried or defeated. The amendments of Messrs. Corning and Stone go into details of administration that ought to be left to the board of directors. Constitutions and by-laws ought to be broad, fundamental documents, and ought not to undertake to provide in detail for all possible contingencies, which is quite beyond human capacity anyway.

The proposed amendment establishing a class of "fellows" in the Institute ought to be rejected. This is un-American, unnecessary, and rather ludicrous. All of the purposes in the minds of the proposers of this amendment will be attained by the union of the Institute and the Mining and Metallurgical Society of America, which has already been agreed to by the councils of the respective organizations.

However, even the inadvertent passage of the "fellows" amendment may not matter very much, for the reason that it is so likely to be treated as a joke that it will be ineffective anyway.

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The Copper Statistics for January

It is now recognized almost everywhere, except in Wall Street, that the monthly reports of the Copper Producers' Association are not entitled to too great attention, for the reason that they reflect the copper situation only in a partial and imperfect way. Also, monthly statistics represent periods too short to show the real trend of things. The matter of most usefulness in the figures of the Copper Producers' Association is the showing of just how much copper is on hand at the refineries at the end of each month.

The January figures show a large increase in the stock, as had been expected previously. For several months back, copper manufacturers, both in Europe and America, have been living largely on their fat and have transferred to the producers the burden of carrying all of the stocks. The producers, or at least some of them, are also now paying the penalty for delaying the new production of 1912. During the first half of that year the refinery production ran far under that of the mine; at present it is overrunning the mine production. The bigness of the refinery production reported in January shows that no attempt was made to misrepresent anything in this particular, and that of course gives confidence in the statistics. However, it appears that some copper may have been speculatively transferred to Europe, going into stock at Hamburg and Rotterdam.

The supply of crude copper to American refiners probably attained its maximum last fall. Since then there has been some falling off in the mine production, owing partly to the natural, seasonal difficulties, and partly to labor difficulties. The shortage of labor in the Rocky Mountain region is in fact a limiting condition in production at the present time. The increase in wages last year was fundamentally to hold the good miners needed. Although the price for copper has now declined, it does not necessarily follow that wages will be reduced. In fact, the Anaconda company has already announced that it will not make any reduction. At Bingham the Utah Copper Co. still seems to be short of men; its production is still running below the normal, although the strike terminated several months ago.

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The Mining Geologist

Economic geology, largely indebted as it is to physics and chemistry for its progress, is nevertheless essentially an inductive science and only as such, if at all, is it entitled to stand on its own feet. Its ultimate recognition as a true science must depend upon the formation of quantitative theories so exact and capable of application as to make it possible to analyze by their means a given territory in a manner equivalent to a chemical analysis of a substance, with results approximately as dependable and at no greater comparative expense.

Such is emphatically not the case at present and often geologic theories seem so inadequate that by many their practical value is held to be mythical and their application to the solution of prospecting and development problems quite futile. Such express their opinion by stating that one man can see as far into the ground as another and prefer to trust to the practical man's subconscious theories, known as "a nose for ore," for finding deposits, and to the law of averages for final financial success. It is unfair, however, to demand too much of a comparatively new line of investigation, but conspicuous examples of the success of scientific theories applied to specific problems of ore deposition will occur to everyone.

Some years ago the prediction was made by a man prominent in the profession that thereafter the consulting engineer would be more often a previously successful op-

erator than a mining geologist, the prediction being based on the fact that all the ore deposits were becoming known and that the question of their availability for exploitation would hinge on the costs attainable. Such a development is probably taking place, but a compensating phenomenon is the shifting of the mining geologists from consulting work to permanent positions with large companies. The increasing frequency of their employment on the staffs of large mining companies is the best answer to the critics of geologic theory. The hard-headed management hires a geologist because it pays.

It is the mining geologist so situated who can best further the growth of economic geology. The development of the theories previously mentioned as necessary can come only from the study of a great mass of accurate data comprising observations correctly interpreted and recorded. No itinerant observer has such opportunities for making a detailed and intimate acquaintance with a formation as the man in a permanent position in one district and to no other work is the acid test of practical experience so such to be applied. It was remarked by the geologist in charge of the highly successful geologic work for the Catskill aqueduct that it was a new experience for his profession to have its theories and statements so promptly and definitely checked up as in that instance, but to the mining geologist this is a daily occurrence and his facts and observations that come through the ordeal successfully can fairly be assumed correct.

It is such material that Mr. Elsing presents in this issue of the JOURNAL, the result of his experience as geologist for the Cananea Consolidated Copper Co. His thesis is, that to predict the ore under any unexplored outcrop, the only possible guide is a knowledge of what was found under other outcrops and he furnishes this information so far as it is known for Cananea.

Guggenheim Exploration Co.

In the reports of the Guggenheim Exploration Co., its chief assets are listed at their cost. By comparison of these figures as they appear in the reports for 1911 and 1912, it is possible to gain some slight idea as to the valuation the Exploration directors set on these stocks, i.e., at what figures they buy and at what figures they sell.

In 1912, 110,000 shares of American Smelters' Securities, pfd. A, were sold at 84; Utah Copper holdings remain unchanged; Yukon Gold was increased 65,246 shares, apparently bought at an average of $3.19; Chino appears in the list at an average of $25.93; American Smelting common at $68.59; and Ray Consolidated at $21.33. The figures on the last three items may not be absolutely accurate, as small amounts of these stocks may have been carried in 1911 in the miscellaneous securities account, which shrank during 1912 from $831,179.12 to $53,010.

On the other hand, Esperanza (3016 shares) and American Smelters' Securities 6% bonds ($1,500,000) disappear from the list of assets as shown in 1911, while the AlaskaYukon account shows a small shrinkage. Esperanza fluctuated in 1912 between £1 3s. 9d. and £2 17s., and the bonds from 102 to 106. Here, too, any inference as to sale must be qualified by the possibility that Esperanza may now be carried in the miscellaneous account.

It also appears from the report that the Guggenheim Exploration Co. now owns 80.9% of the authorized capital stock of the Yukon Gold Co., which it acquired at $3.56. This is a very favorable figure compared to the price at which this stock was sold to the public. Fortunately for the public, as it turned out, Mr. Lawson's siren songs induced it (the public) to take only a relatively small part of the total, since which time there has been no distribution of this stock. This Yukon Gold Co. promises to be an example of real mining, i.e., the profit will all have to come out of the gold obtained from the ground, and not partly out of shoes, woolen goods, or whatever else may have served originally in making the savings of subsequently unlucky investors.

Leadville Calamine

Our Denver correspondent reported a few weeks ago that the zinc smelters of Kansas and Oklahoma had agreed to accept calamine ore, containing only 18% zinc, from Leadville, Colo. That the zinc smelters employing the Belgian process should be willing to take ore so low in zinc is a remarkable change in metallurgical practice. Ore of that grade has been smelted in Silesia by the Silesian process from time immemorial, but it is not many years ago that it was considered that the smelters employing the Belgian process had to have ore averaging about 40% zinc at least.

For a long time, however, American smelters have been accepting Leadville calamine containing about 25% zinc. Their willingness to take that, and now a still lower grade, is, of course, attributable to the situation in Kansas and Oklahoma with respect to fuel supply. The natural gas upon which these smelters are dependent has for a long time been becoming more and more costly. The type of roasting furnace commonly used by them is extremely wasteful of fuel. When gas was cheap that was not minded very much, characteristic carelessness here exhibiting itself, but with the increasing cost of gas this shoe has been pinching very severely. Consequently, while during last year Western blende fetched a relatively low price, leaving a large margin to the smelters, calamine at the same time commanded a relatively high price, the explanation being that the blende has to be roasted while calamine does not.

The proposal of a member of the Colorado legislature, contained in a bill recently introduced, to create a state industrial commission, which, among other things, is to build a smelting works near the State School of Mines as a relief to the ore producer from extortionate charges, is in the main a proposal of singular excellence, but we do not think that this embryo commission ought to be tied to a location "as near the State School of Mines as possible," inasmuch as it is possible, nay probable, that a better location from the industrial and commercial standpoints might be chosen.

German iron trade was strong and active throughout 1912, and the Iron Trade Union reports a good increase in production. The total make of pig iron for the year was 17,852,571 metric tons, an increase of 2,295,541 tons, or 14.8%, over 1911, and the largest production ever reported for the German Empire. Steel production will doubtless show a parallel increase.

BY THE WAY

The daily papers report another of the world's greatest iron-ore discoveries, this time from southwestern Wisconsin, where a bed 60x40 miles is thought to contain 54 to 60% iron, and it is announced that an important iron interest has optioned 2000 acres. We hope this is true and that a large deposit of iron ore will be added to our resources. However, we remember the newspaper discovery of last year in Fulton County, Pennsylvania, and shall wait for a report from the state geologist of Wisconsin.

⁂

The reports of the companies which treat radium ores make queer reading to the ordinary metallurgist and millman. In the report of the Radium Hill (Australia) Co., we read that 95 tons of concentrates yielded 3⅔ mg. of radium bromide per ton of concentrates. In the recent Mudgee find, the ores were investigated with a microscope. It was announced last year that it was estimated when the St. Joachimsthal (Austria) works was in full operation the output would be fully five grams per year of radium salts, while the 1911 output was officially placed at 2.647 grams of $RaCl_2$, valued at $214,928.

⁂

It is remarked by *Mines and Methods* that copper producers having relieved themselves of the strain they professed to be making to prevent "a runaway copper-metal market" by lowering the price more than a cent a pound, it is now in order for the manipulators of Utah Copper to begin explaining how much easier it will be to increase dividends with the metal at 15c. or 16c. than it would have been had the price been held at 17¾c. or advanced to 20c.; and it is suggested that George L. Walker probably can make the "argument" as well as anybody.

⁂

The ubiquitous Cornishman has impressed much of his terminology on the mining industry, some expressions persisting in one district and others in another. Thus a newcomer in Grass Valley, Calif., is puzzled by many of the terms, largely Cornish, which he finds in use. There a shoveling "plat" is a "sollar." A machine drill is "rigged in" and "rigged out," not "set up" and "torn down." A stull is called a "post," and the term "stull" is reserved for a dry-wall pillar built for roof support in the rather flat stopes. A stick of powder is a "sack." The vertical shaft is called the "downright," and the man cage, which boasts a different *alias* in every camp, is here a "dolly."

⁂

How much should a professor of geology know of geography? The following are extracts from the testimony of a professor of geology called as an iron-ore expert, to give evidence in the Steel Corporation suits:

"What is the Lake Superior district?" asked Mr. Lindabury. "The iron-bearing district south of Lake Superior, in the states to the south of the lake, Wisconsin and Michigan," replied the professor. "Where is the Mesabi range?" persisted the attorney. "Oh, in Wisconsin," said the professor, with an air of authority. "Are you sure of that, professor?" asked Judge Dickinson, who was beginning to be alarmed. "In Wisconsin," repeated the professor. Though evidently not a lake sailor, the professor was rather at sea about other points. He stated, in answer to a question, that "Lake Superior runs into Lake Ontario." When asked the position of Gary, Ind., "He knew it was on some some lake," he said, "but whether Lake Superior, Lake Erie or Lake Ontario he could not tell." Perhaps a map of the United States would be an acceptable present to the professor.

⁂

News comes of a new uprising in the City of Mexico that seems likely to be of serious consequence. Madero is reported to be besieged in the castle of Chapultepec, awaiting reinforcements. Gen. Bernardo Reyes, while leading one division of the attacking force, was shot and killed, leaving Felix Diaz at the head of the new movement. The spectacular appearance from prison of the former president's nephew, coupled with the magic name of Diaz, will make a strong appeal to Latin hearts and, with the probable aid of many supporters of the former administration, the present revolt, if it gets a fair start, promises to be the most serious one since Madero's assumption of the reins of the government.

⁂

The average layman knows little of the source of the metals he uses in his everyday life. In his mind there is no conception of mining as a basic industry; his impression is that mining is an opportunity for a "wild" gamble on stock certificates. An amusing little incident, showing the ignorance that some Canadians have of their own country is related by the Cobalt *Nugget*. Not long ago a Montreal newspaper man came into the country to meet the first wheat train over the Transcontinental. On his trip he encountered a mining man, and the conversation drifted to Cobalt and its wonderful career as a mining camp. "Let me see," said the newspaper man, "what do they mine in Cobalt?" Disgust clouded the face of the M. M. "Molasses," he replied.

⁂

Under the caption of "Interesting and Valuable Information about an Enormous Gold Discovery in Dutch Guiana," one P. H. Lund, manager for the High Grade Venture Co., Denver, Colo., writes in the *Daily Mining Record* of Feb. 1, 1913. It is not clear to the ordinary reader whether this communication, which occupies nearly a page, is an advertisement or a news report, the type being the same as that of the publication in which it appears, except for the profuse use of capitals and some black letters. This, together with the coupon that appears at the end of the article, is sufficient to tell the wise reader that the whole thing is an advertisement. Our interest was attracted by the quotation of "A report made by E. H. Teats," which "report was written for the ENGINEERING AND MINING JOURNAL." The "enormous gold discovery" is alleged to have been made by J. F. Waller, "a citizen and explorer" of Dutch Guiana, but not many particulars about it are given. Mr. Teats is quoted in order to give an understanding of "the existing conditions in Dutch Guiana." Mr. Lund neglected to state that Mr. Teats' article appeared in the JOURNAL of Mar. 24, 1906. Also, he is not at all careful about indicating where Mr. Teats' remarks end and where his own begin.

Proposed New Railroads for Alaska

On Feb. 6, President Taft sent a message to Congress recommending the government construction of two independent railroads in Alaska of a length of 733 miles, and an estimated cost of $35,000,000. It is recommended that the Panama Canal equipment should be taken to Alaska to build these railroads. A commission, which has been investigating Alaska's needs, recommends that the first system should lead from Cordova by way of Chitina to Fairbanks, and the second from Seward around Cook Inlet to the Iditarod. The first system would tap the Bering, and the second the Matanuska coal fields, says the N. Y. *Sun:*

The commission recommends the building of a railway from Chitina to Fairbanks, 313 miles, estimated to cost $13,971,000, with the provision that if this railway is built by other interests than those controlling the Copper River & Northwestern R.R., and if an equitable traffic arrangement cannot be made with it, connection shoould be made with Valdez by the Thompson Pass route, 101 miles, estimated to cost $6,101,479.

The commission believes Cordova offers the best present ocean terminal for the Bering field, but that it would be uneconomical to haul the Matanuska coal either to Valdez or Cordova; therefore the logical outlet of the field would be Seward:

If commercial development of these two fields should disclose that the quality of the coal is the same in both, the Bering River field would have the advantage of greater proximity to open tidewater. A branch line from Copper River Ry. to the Bering River field, a distance of 38 miles, at an estimated cost of $2,054,000, is recommended to afford an outlet for the coal on Prince William Sound and into the Copper River Valley and the region where there is at present the largest market for Alaska coal.

The commission recommends a railway from Kern Creek, the present inland terminal of the Alaska Northern Ry., to the Susitna River (distance 115 miles, estimated cost $5,209,000), with a branch line to the Matanuska coal field (distance 38 miles, estimated cost, $1,618,000), and an extension of the main line through the Alaska Range to the Kuskokwim River (distance 229 miles, estimated cost, $12,760,000).

The inference to be drawn from this report is that the commission believes "its recommendations can certainly be carried out only if the government builds or guarantees the construction cost of the railroads recommended. If the government is to guarantee the principal and interest of the construction bonds, it seems clear that it should own the roads, the cost of which it really pays. This is true whether the government itself should operate the roads or should provide for their operation by lease or operating agreement. I am much opposed to government operation, but I believe that government ownership with private operation under lease is the proper solution of the difficulties here presented."

Canadian Corundum Mill Burns

SPECIAL CORRESPONDENCE

The corundum mill at Craigmont, Ont., operated by the Manufacturers' Corundum Co., was totally destroyed by fire, Feb. 3. The material of which the buildings were built was inflammable, and an hour after the fire started, the plant was completely destroyed.

This plant had an output of about 125 tons per month and a total of 130 men were employed, with a yearly pay roll of about $120,000. The loss will be serious to that part of the country as the farmers in the surrounding district worked in the mines and also found a ready market with the company for their produce. The property was owned by the Canadian Corundum Co. and was under lease to the Manufacturers' Corundum Co., which also operated the Burgess mines, about 20 miles distant. On account of the trouble arising between the holding company and the lessees, and the difficulties of competing with the manufactured abrasive products, it is doubtful if the mill will be rebuilt.

Standard Screens for Grading Analyses

Prof. Robert H. Richards, of the Massachusetts Institute of Technology, emphasizes the need of a standard set of screens for grading analyses so that published results of investigators will be comparable. The Rittinger scale, in which the ratio of increase or decrease between adjacent screens is fixed at $\sqrt{2}$, is approved by Professor Richards, but since no manufacturer had adopted and made screens according to this standard, no practical use could be made of it. The standard screens adopted by the Institution of Mining and Metallurgy he considers as open to criticism in three particulars:

(1) In order to retain the use of the word "mesh" and make it significant, the size of the wire in each sieve was fixed, the wires being the same diameter as the holes. This, of course, was essential for the size of wire ordinarily used in making 14-mesh screens, for instance, may vary from 0.030 to 0.061 in. in diameter. The disadvantage of the I. M. M. set is that the large wires necessary in the coarser screens make the manufacture of double-crimp wire cloth difficult.

(2) There is no constant ratio between adjacent screens, making it difficult to draw deductions from curves and of comparing results.

(3) The use of the term "mesh" in reporting results by those not equipped with I. M. M. screens is confusing.

Professor Richards holds that a set of screens standardized according to the size of its hole instead of the number of meshes, that has a constant ratio from one end to the other, and allowing the use of wires that are smaller than the holes, admitting of the use of the best kind of double-crimped wire cloth, should have great advantages over the series based upon the mesh. The W. S. Tyler Co. is now making a set of screens based upon the Rittinger scale. Professor Richards believes that this set meets all the requirements for grading analyses and recommends its general adoption as a standard.

Full Weight Pipe

It was recently announced by the National Tube Co. that in the future it will make only full standard weight pipe; i.e., no more "Merchant" pipe is to be made. After The National Tube Co. made this announcement, other mills followed its initiative, and practically every pipe mill has now announced that the manufacture of the so called "Merchant" weight pipe will be abandoned.

This is a matter of much importance to engineers of this country. In the past there have been legitimate uses for "Merchant" pipe, that is, pipe lighter in weight than the standard, but the necessity on the part of the jobber for keeping in stock several grades of pipe has produced in the mind of the consumer more or less uncertainty as to the grade actually received.

Full-weight pipe is suitable for all purposes for which the "Merchant" weight has been used, but the opposite is

not true. The advantages to the ultimate consumer of a single standard are obvious, for the average consumer is not always in a position to weigh every piece of pipe he gets, and if there is but one standard, and this a high one, the innovation will, no doubt, be regarded favorably by pipe consumers.

Thornton Mining Dial

A new form of mining dial has been introduced by A. G. Thornton, Ltd., of Manchester. Figs. 1 and 2 show the general appearance of the instrument in its level and tilted positions. The plate, which is the foundation of the instrument, is formed of a single casting for both the vertical and horizontal axes, thus giving accuracy so long as the dial is not strained and distorted. The semicircular vertical arc is made to fold down to the outside of the compass box when not in use, its engraved face being then protected. It is pivoted in the plane of the arc, and is brought to rest in a truly vertical position by a circular stop-pin. Readings up to about 64° can be taken.

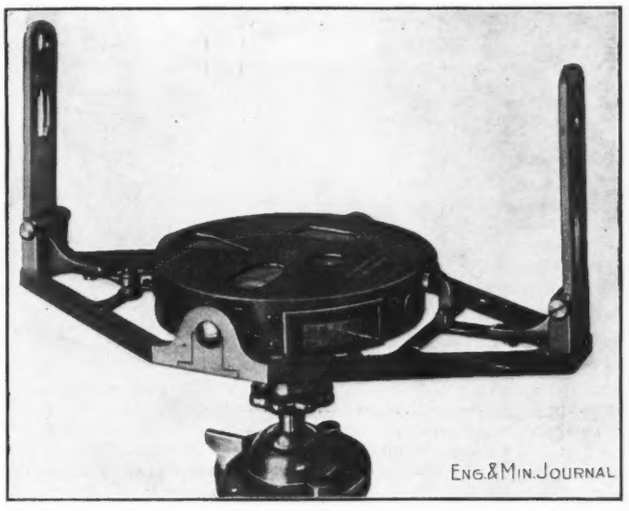

FIG. 1. GENERAL ARRANGEMENT OF THORNTON DIAL

A small plate is attached to the north end of the needle, on which a fine line is engraved above the point for easy and accurate setting, thus retaining the magnetic advantage of a pointed needle. This arrangement has advantages. It is easier to illuminate two surfaces in the same plane than to see an engraved ring and needle point when using the miner's lamp. Moreover, it is also easier to set two engraved lines opposite one another.

The needle in this dial is balanced three-fifths of its total length from the north end, thus giving with a 5-in. needle the accuracy and ease of reading which would be obtained by a 6-in. needle of the usual form pivoted at the center. The cover plate of the compass box is cut away at the north, tapering to a point toward the south, so that when the needle appears in the center of the "V" it is being viewed from due south. A trough compass is used and the needle is required to find the north point only, as in taking readings all around the circle, there is a liability to error at some part of the circle, owing to the magnetic attraction of some screw, or of some small particle of magnetic material in one of the castings. With a circular compass needle, it is practically impossible to take readings of less than about one-eighth of a degree, but by means of a trough compass with two verniers subdividing the circle, as in this instrument, angles can be read to three minutes.

An interesting detail of design is the lifter, which consists of a screw acting on a spring, the gradual lifting and lowering of the needle by this means minimizing the risk of damage to the pivot. The verniers for protection against dust and damp are read through glass windows, the whole of the graduated circle being inclosed. The

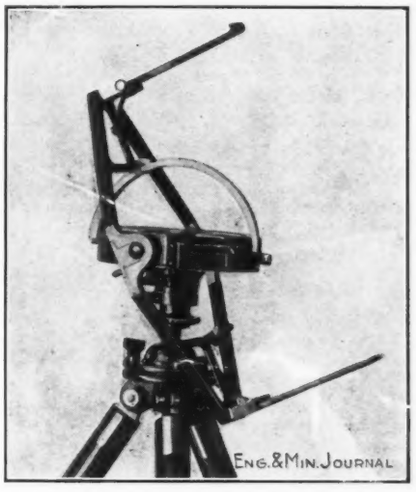

FIG. 2. POSITION FOR INCLINED READINGS

levels are placed in the compass box, and these, together with the trough compass, are protected by a fixed cover offering almost complete protection to the glass face. Hence, a miner's lamp may be placed upon the center.

The Secretary of the Institute

I thank the JOURNAL for its fair-minded editorial of Feb. 8, 1913, concerning my relations with the affairs of the American Institute of Mining Engineers; although there are a few statements made which, by suggestion, might lead to an improper conclusion, notably the placing on my shoulders of responsibility which rightly belonged to the governing bodies of the Institute.

I have tried in vain to obtain a statement of any charges against me, and an opportunity to meet them. As to the charges which have been published, they do not concern me at all, except as regard to the excursion to Japan, which was a separate affair, not belonging to any meeting of the Institute. This excursion has been investigated already by a special committee of the council and directors, appointed at my request, and I was exonerated from the few complaints and charges which had been preferred.

Concerning the excursions to New Haven and Spokane, specifically referred to, the facts are that there was no excursion to New Haven, and that I had nothing to do with the management of the excursion to Spokane.

My assurance may be accepted that I shall seek vindication through the proper channels, since I realize the impropriety of a discussion in the columns of the technical press.

JOSEPH STRUTHERS.

New York, Feb. 10, 1913.

PERSONALS

J. B. Tyrrell has returned to Toronto, Ont., after having spent two months in London, England.

Walter Harvey Weed, of New York has been a visitor in the Lake Superior Copper district of Michigan.

R. G. Thomas left Miami, Ariz., Feb. 2 for an examination of mining properties in New Mexico, near Hillsaide.

J. W. Mercer has returned from Ecuador, where he has been for several months attending to his mining interests.

Quincy A. Shaw, president of the Calumet & Hecla, has been a visitor at the property for the past 10 days and has returned to Boston.

Howard M. Hanna, Jr., of the firm of M. A. Hanna & Co., Cleveland, O., has been chosen a director of the Republic Iron & Steel Company.

George Hentz, of the United States Smelting, Refining & Mining Co., has been visiting properties in southern California and has returned to Salt Lake.

Milton O. Knauss has resigned as superintendent of the Macungie, Penn., furnace of the Empire Steel & Iron Co., and has been succeeded by John Thomas.

Max Klar, who has been engaged in installing retort systems of wood distillation for chemical plants in northern Michigan for the past three years, has returned to Germany.

William B. Fisher has retired from the management of the Davis-Daly Copper Co. at Butte, Mont., being succeeded by M. W. Atwater, who has left the Butte & Superior Copper Company.

C. L. Miller, general manager American Steel & Wire Co., Pittsburgh, who has been in ill health for some time, has been granted a six months' leave of absence. He is now in California.

James L. Bruce, general manager of the Continental Zinc Co., Joplin, Mo., is assisting J. R. Finlay in his examination of the property of the St. Joseph and Doe Run companies in southeastern Missouri.

Dr. H. R. de Holl, who has been assistant superintendent of the byproduct plant of the Tennessee Coal, Iron & Railroad Co., at Corey, Ala., is now superintendent of the by-product ovens of the Inland Steel Co., Chicago.

John M. Bush has been appointed general superintendent for the Cleveland Cliffs Iron Co. in the Iron River-Crystal Falls district, with headquarters at Iron River, Mich. He has been for several years superintendent of the company's Ashland mine at Ironwood.

John Price Jackson, dean of the school of engineering at the Pennsylvania State College, was elected president of an association formed at Washington, D. C., recently, embracing the engineering divisions of the land grant universities and colleges of the United States.

C. F. Buck, who built the Hayden, Ariz., plant of the American Smelting & Refining Co. and who has been in charge of the rebuilding of the Tacoma, Washington, plant of the same company, has resigned from the latter position to become chief engineer and superintendent of construction with the Dominion Nickel Copper Co., Ltd., Sudbury, Ont., where he will have charge of the designing and erection of a new smelting plant.

OBITUARY

Gabriel Hirsch, of the firm of Aron Hirsch & Sohn, died on Feb. 6, at Halberstadt, Germany, aged about 54 years.

James Morton Wright, president and general manager of the Joe Dandy Mining Co., Cripple Creek, Colo., died Feb. 1 at that place.

Karl Wittgenstein, one of the leading steel manufacturers of Austria, who has often been referred to as the "Austrian Carnegie," died at Vienna recently, aged 67 years.

Sylvester Clark Smith died at Hollywood near Los Angeles, Calif., Jan. 26. He was about 54 years old, born in Iowa. He went to California in 1879. After teaching in the public schools until 1885 he began the practice of law at Bakersfield; was elected to the State Senate in 1894 and re-elected in 1898. In 1904 he was elected to Congress and subsequently reëlected, until in 1912 his health failed. Through his position in Congress and as editor and publisher of the Bakersfield "Echo" he was of much assistance to the oil producers of California in their effort to obtain adequate legislation, but ill health during his last term in Congress prevented the accomplishment of much of the work that had been planned.

Raphael H. Wolff died at Berlin, Jan. 23. He was long a well known figure in the iron trade of the United States and also had a wide acquaintance among iron and steel manufacturers in Germany. He was born in Germany, and came to the United States in 1870; his first employment was with Pratt & Whitney, Hartford, Conn. For many years he was an importer of iron and steel in New York and was a pioneer in the importation of wire rods and steel billets. He established a plant in New York, where he was engaged for many years as head of R. H. Wolff & Co., Ltd., in the manufacture of cold-rolled strip steel and of high-grade wires, including piano wire. He disposed of his wire business in 1902 to the Washburn Wire Company. Later he became European representative of the Crucible Steel Co. Later, after a careful study of the field of electrometallurgy Mr. Wolff became the representative in the United States of Dr. P. Heroult, inventor of the Heroult electric furnace, and was an eager and persistent pioneer in the electric refining of steel. He conducted the negotiations which resulted in the acquisition of the American rights in the Heroult furnace to the United States Steel Corporation. He was also largely instrumental in the establishment of the ferrosilicon plant of the Electro-Metals Ltd., at Welland, Ontario.

SOCIETIES

Chemical Metallurgical & Mining Society of South Africa—The second yearly mining exhibition, organized by this society, is to be held at Johannesburg, Transvaal, in April, lasting about two weeks.

Iron & Steel Institute (Great Britain)—The Annual Meeting will be held, in London, May 1 and 2, 1913. The Bessemer gold medal will be awarded to Adolphe Greiner, general director of the Société Cockerill, Seraing, Belgium, vice-president of the Institute.

International Commission on Annual Tables of Physical and Chemical Constants—The American members of this commission are: W. D. Bancroft, Carl Barus, A. L. Day, A. A. Michelson, W. A. Noyes, Ira Remsen, Joseph W. Richards, Theodore W. Richards, Alexander Smith, S. W. Stratton and W. R. Whitney.

Engineers' Society of Pennsylvania—At a recent meeting at Harrisburg George S. Comstock was elected president, for the ensuing year. The other officers chosen are: Farley Gannett, first vice-president; John Price Jackson, second vice-president; Edward R. Dasher, secretary; R. Boone Abbott, treasurer; F. E. Langenheim and C. P. Turner, resident directors, and Albert F. Damon, non-resident director.

American Institute of Mining Engineers—At the meeting in New York, Feb. 18-21 the new Iron & Steel Section will hold a general discussion on processes for making steel ingots, based on the following questions: (1) Is the present method of getting rid of the pipe by cropping, a safe and reliable device for making sound steel? (2) It is desirable to increase the amount of metal arbitrarily cropped off the top of an ingot, and, if so, what would be a fair excess price to pay for cropping off 20%? (3) Is it commercially practicable to make ingots without pipes or blow holes, and what additional expense of manufacture would be justified to accomplish this result? (4) What process for making pipeless ingots seems the most promising for commercial success, and why?

The following papers dealing with the subject of sound steel ingots will be presented: "The Production of Solid Steel Ingots," by Benjamin Talbot; "Piping and Segregation of Steel Ingots and Ductility Tests for Open-Hearth Steel Rails," by P. H. Dudley; "The Use of Anti-Piping Thermit in Casting-Steel Ingots," by E. A. Beck. Other papers on iron and steel topics that will be presented follow: "Valuation of Iron Mines," by J. R. Finlay; "Notes on Cast Iron," by Albert Sauveur; "New Design of Open-Hearth Furnace, Using Producer Gas," by H. F. Miller, Jr.; "Why Does Lag Increase with the Temperature from Which Cooling Starts?" by Henry M. Howe; "Microstructure of Sintered Material," by B. G. Klugh; "Blast Furnace Slag Analyses for 24 Hours," by F. Louis Grammer; "Methods of Preparing Basic Open-Hearth Steel for Castings," by H. F. Miller, Jr.; "Comparative Notes on Steel Rail Rolling," by Robert W. Hunt.

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Feb. 6

The Kennedy Extension vs. Argonaut Apex Suit will probably go to trial in April in the superior court of Amador County. This suit has nothing whatever to do with the Kennedy mine, nor is there any controversy legal or other between the Kennedy Mining Co. and the Argonaut Mining Co. There is a general impression within and without Amador County and the Mother Lode region that the Kennedy Extension is an extension of the Kennedy mine and a part of the Kennedy Mining Co. This is not true. The mine or mining claim, within the lines of which the Argonaut is charged by the plaintiff in the suit with having tresspassed, and extracted large amounts of ore, was formerly known as the Amelia and now better known as the Muldoon. There are two claims, one situated east, the other south of the Argonaut; the Kennedy adjoins the Argonaut on the north. There is no physical relation between the Kennedy and the Kennedy Extension mines. The properties are not related in situation or ownership. The impression to the contrary is largely due to the use of the name "Kennedy" by the latter company, and in a measure it may be said to be due to the policy of the Kennedy Mining Co. of avoiding publicity.

Restriction of Placer Gold Dredging or its prohibition will be opposed by the Marysville chamber of commerce; a legislative measure to effect which is now being considered. Yuba County is especially interested in the uninterrupted continuance of gold dredging, not alone because of its position of first in rank of gold producers in California resulting from the dredging industry, but also because of the economic benefit resulting from the operation of gold dredges on Yuba River. The failure of the engineers of the War Department to plan and construct adequate protection of Marysville and other towns and the farms from the flood waters of the Yuba was corrected by the dredge operators, the Yuba Consolidated Goldfields and the Marysville Gold Dredging Co. These operators entered into contracts with the government to build retaining walls along the Yuba in the Hammonton and Marigold fields; and this has been and is being done by the distribution of the tailing of heavy gravel from the 14 dredges in operation. Another instance of the economic benefit to towns and farms resulting from gold dredging operations is plainly evident in the Oroville field. Oroville had for a number of years been damaged in property and lives endangered by the flood waters of Feather River. The dredging operations along the river and adjoining the town left the municipality no other recourse than the construction of a concrete restraining levee, at a cost of $85,000, which in the first flood that followed saved the town more than its cost. In the early days of dredging in that field the people of Oroville were bitterly opposed to the dredging operations, because they said their lands were destroyed and their town rendered more vulnerable to floods. Had they then considered the economic possibilities of the industry it is not unlikely they could have saved the municipality the expenditure of $80,000, or at least a portion of it, by bargaining with the dredging companies to build the levee or restraining wall with the tailing gravel. As to the spoiling of the lands for horticulture, as was then the complaint, the lands have largely been reclaimed by the distribution of the tailing gravel.

DENVER—Feb. 7

El Paso Filed Suit Against the C. K. & N., recently in the district court at Cripple Creek. The El Paso company asks that the C. K. & N. company be compelled to pay $1,000,000 damages for ore removed from a vein claimed by the plaintiff; that it be ejected from further work on the vein in dispute, and that the El Paso company be decreed to be the owner of the vein, which is the principal vein in the C. K. & N. property. An injunction has been asked for, and if obtained will force the C. K. & N. to suspend operations for at least 30 days. Meantime, El Paso will carry on a large amount of apex work to prove that it is the owner of the Columbia vein. Most of the rich ore that has come out of the El Paso mine has been taken from the Columbia vein, and the same is true of the C. K. & N. mine. The latter has taken out $1,500,000 from this vein, and El Paso claims at least $750,000 of this because of apex rights. One of the questions to be settled is whether or not recovery of ore mined over six years ago can be made by the El Paso company, six years being the period of the statute of limitations. Another question to be settled is if, when a secondary vein departs from both side lines, the El Paso company has the right to follow it at all. Involved also is the question as to what extent priority of patent is conclusive as to priority of location where two claims conflict. If the El Paso establishes the rights it claims, it will seriously cripple the C. K. & N. property. It says in its complaint that if it is right in its contention, the C. K. & N. will be insolvent. The vein dips from the El Paso into the C. K. & N. El Paso claims that its title gives it rights to mine all ore below the 1000 level and a large part that comes from above this level. The attorneys for the El Paso notified the owners of the C. K. & N. that ore was being removed illegally from the apex veins of the El Paso and asked that it be stopped. The C. K. & N. denied the charge and continued to mine along the veins they have been working for some time.

BUTTE—Feb. 5

Yellowstone Portland Cement Co. difficulties have been settled. These arose some time ago, and resulted in the cessation of construction operations upon the mill being erected at the entrance of Yellowstone Park. It is believed that the plant will be ready for operation by June 1. There is estimated to be approximately 1,000,000,000 tons of pure limestone on the company's property, the deposit being the result of the action of a geyser which brought the carbonate of lime to the surface in solution, where it was precipitated, forming terraces similar to those at Mammoth Hot Springs in the Park. With the exception of the deposits in the Park, this is the only known deposit of limestone which is free from iron, magnesia, phosphorus and other discoloring elements, and from which pure white cement can be manufactured.

The Timber Butte Milling Co. has just received a 400-hp. Westinghouse electric locomotive, which is being used to haul timber and supplies for the construction of the zinc concentrator on the north slope of Timber Butte. The railroad to the property, which joins the Milwaukee railroad about 1½ miles north of Butte, was recently completed, and while work on the millsite has been going on in a small way for several months, it has been held back until the completion of the road and the arrival of the locomotive. A machine and a blacksmith shop have been erected, concrete forms for the ore bins built, and excavations for the mill foundations are now in progress. The ore bins are below the mill and the ore will be conveyed to the plant by a 650-ft. belt conveyor. The mill will have an initial capacity of 400 tons of ore per day, and it is hoped that it will be in readiness for operations within six months. In order to decide upon the best method for concentrating zinc ore, experimental work has been in progress for some time at the Butte Reduction Works, and although no definite decision has as yet been reached, wet concentration in some form will be used, the water to be obtained from a series of wells bored last summer on the flat below, from which it has been demonstrated that 800 gal. per min. can be pumped.

SALT LAKE CITY—Feb. 6

The Bingham Copper Co. is being reorganized, 515,000 shares of stock having been deposited with the committee and the remainder purchased for the benefit of the reorganization. The property has been examined by a competent engineer and a report on the titles has been obtained. A quarter interest in the Diamond Extension and a half interest in the Diamond mining claim is being added. The reorganized company is to be called the Utah Lead & Copper Co., incorporated under the Maine laws with a capitalization of $500,000. First mortgage 10-year bonds for $100,000 are to be issued. Stockholders are to receive one share of new stock for four shares of old, and bonds equal to the assessments paid in, together with a bonus of one new share per dollar paid in.

An Appropriation for the Utah Engineering Experiment Station of $15,000 annually is provided for the mining and metallurgical research department in a bill brought before the state legislature Jan. 31 by Senator W. Mont. Ferry. The purpose of the department as outlined in the bill is to conduct experiments alone or in coöperation with the U. S.

Bureau of Mines with the object of finding methods for treating low-grade ores, of securing a greater extraction, of obtaining information for the benefit of the mining industry, and furthering the conservation of the mineral resources of the state. The department would be connected with the state school of mines of which the engineering experiment station is a part. The expenditure of the appropriation would be under the direction of the board of regents of the university. The bill has been referred to the committee on mines and mining.

The Utah Chapter of the American Mining Congress met Feb. 1 and discussed the appropriation bill now before the legislature. Addresses were made by J. F. Merrill, C. E. Allen, W. H. King, George Dern, W. Mont. Ferry, and others. Proposed legislation on tax revision was discussed. One bill not permitting mine owners to deduct the amount spent on improvements, when taxed on their net profits was strongly criticized; such a measure, it was held, would result practically in taxing the gross receipts of mines. W. H. King spoke of the visit to Washington of the committee in the interests of Utah lead producers. The duty on lead ore, he said, was now 1½c., and he thought that Congress would provide either a specific duty of 1⅛c. or an ad valorem duty that would be equivalent to this amount. Another meeting will be held Feb. 8 to further consider legislation affecting the mining industry. A committee consisting of C. E. Allen, W. H. King, G. Dern, Duncan MacVichie, and G. W. Lambourne was appointed to take up matters of interest to the mining industry with members of the state legislature.

JOPLIN, MO.—Feb. 7

A Setback in mining operations has been experienced, due to the recent slump in the spelter market and the consequent decline of concentrates to a $45 and $46 base. Mine operators are trying to evolve a plan to curtail output and force the smelters to pay a higher price for ore, but thus far no concerted action has been taken. At the prevailing base price a number of the mines in the north Webb City district are forced to shut down and a general decrease in the wage scale is being made all over the camp. Day-pay men are being cut 25c. per shift, while shovelers are being cut from ½c. to 1c. per can. Some discontent is noted, but the majority of the men are willing to take the cut rather than have the mines shut down. Labor is plentiful, and the men are informed that there are others willing to take their places.

NEGAUNEE—Feb. 6

A meeting of Michigan tax-payers and their representatives was held in Lansing during the last week in January at the instigation of state authorities, in order to allow all interested parties a hearing on the tax question. Directors of the association were chosen to serve during the ensuing year, and the following recommendation was among others made to the legislature: "That the State Tax Commission be given authority to remove assessing officers who do not, in their valuations, conform to the requirements of property at its fair cash value."

The Mechanical Drying of Iron Ore was recently mentioned in these columns in connection with the two Ruggles-Coles driers to be installed at the Brunt mine of M. A. Hanna & Co., it is now announced that the two Atlas driers which were in use at the mine during the last year treated 105,000 tons of ore. This was mixed with crude mine shipments, thus materially lowering the moisture content of the whole. It was found, however, that the Atlas driers were too light, and they will be reinforced. The new Ruggles-Coles driers will be of heavier construction and each drier will reduce the moisture from 18% to 6% in 22 tons of ore per hour.

Gogebic Range operations were abandoned recently by the Cleveland-Cliffs Iron Co., by giving up the lease of the Ashland mine. The company is preparing to develop properties in the Iron River district, where it has been diamond-drilling for several years. This company has formerly confined operations principally to the Marquette district, where it is the dominant interest, but is now devoting attention to the Iron River and Crystal Falls districts; the policy of the company has been to concentrate its activities. Its Minnesota holdings are small, the Crosby mine on the Mesabi range being the only producer, and it has no mines on the Old Menominee range. This policy of centralization is unlike that of several of the other large iron-mining companies, which have mines scattered over the six ranges of Michigan and Minnesota, making in some cases a rather loosely held together organization. In the Iron River district the Cleveland-Cliffs Iron Co. has at least one fully proved orebody, the Erickson, which J. R. Finlay estimated in 1911 at 732,000 tons; this is just northeast of the Rogers mine, of the Munro Iron Mining Co. The Erickson comprises the southwest quarter of Sec. 21, 43-34. Considerable diamond-drilling has been done in the extensive territory between the Rogers and Chicagon mines, but with the exception of the Erickson property, the results have not been announced. At several other places in the Iron River district, drilling was carried on under the advice of the company's geological department, but no large finds have been reported. The company's activities in the Crystal Falls district are as yet in the exploratory stage; diamond-drilling and test-pitting are being carried on in the vicinity of the Mastodon find of the Longyear company.

DEADWOOD—Feb. 8

The 1912 Production, as estimated by the director of the Mint and the Geological Survey, shows a substantial and gratifying increase over 1911, and in that year a new high record was made. The gold output is given at $7,795,680 in 1912, an increase of $366,180 over 1911. The increase in silver production is only 496 oz., 200,796 oz. having been turned out. The increase in the price of silver, however, is responsible for an increase in the gross value of $15,386. The Homestake, Golden Reward, Trojan, Wasp No. 2, Victoria, New Reliance, Richmond and Monarch properties all show an increased production for 1912, and practically the only property showing a falling off is the Mogul. This company's mill was destroyed by fire in March, 1912, and resulted in the company's production dropping $200,000 below normal.

TORONTO—Feb. 8

The growth of the mining industry was alluded to at the opening session of the Ontario legislature, Feb. 4, by Lieutenant-Governor Sir John Gibson, who said: "The mineral products for the year amount in value to approximately $45,000,000. Of this amount the output of silver was nearly $19,000,000, of gold about $2,000,000 and of nickel $4,500,000, and of copper $1,500,000. The production of these minerals greatly exceeds in value that of any previous year." The speech also foreshadowed legislation affecting the hours of labor in mines.

CHIHUAHUA, MEXICO—Jan. 30

Large smelteries have been closed down as a result of the fuel shortage, and unless relief is shortly given, the remaining plants will be forced to suspend. The plants thus far affected are the Chihuahua, Velardeña, Monterey and Matehuala plants of the American Smelting & Refining Co., and the Monterey smeltery of the Towne interests. The Aguascalientes plant of the American Smelting & Refining Co. has been operating with but three furnaces for some time, and the Torreon smeltery of the Cia. Metalurgia de Torreon is running at small capacity. A number of milling plants, as well as mines, have also suspended for the same reason, and unless a fuel supply is obtained soon the majority of the mines in all the large camps will be compelled to shut down. With the smelteries idle, the mines have been asked to cut down shipments, and may be forced to suspend production entirely.

Little coal has lately been mined in the Coahuila fields and scarcely any coke produced on account of strikes and the depredations of rebel bands. Following this came the tie-up of a larger part of the National system by striking mechanics. Lastly both lines from Chihuahua to El Paso have been out of commission for more than 10 days, and no fuel can be brought in from that direction for some time on account of the rebel revolution. On the National lines a number of bridges were burned and the rebels appear to be in sufficient number north of Ahumada to interfere with traffic for some time.

The railroads were also heavy sufferers on account of fuel scarcity and shortage of skilled labor, while all the rolling stock is in bad shape. The Mexico Northwestern Ry. is making no effort to repair the last damages to its lines on the Pearson-Juarez division, so long as the government cannot guarantee protection from the destructive bandit rebels. Service is again established over the Parral and Durango branches of the National lines, but there is no certainty that traffic will not be again interrupted at any time. The mines of Santa Eulalia and Naica are operating uninterruptedly, but few mines are running in the Parral, Santa Barbara, Indé, Guanacevi, Magistral, Guadalupe y Calve or other camps remote from transportation facilities. In western Chihuahua, the Yoquivo, Dolores, Batopilas and Concheño companies have cyanide plants in commission and are making steady production. The Rio Tinto Copper Co. is keeping its Terrazas mines and reduction works in regular operation, and has a sufficient supply of fuel on hand for 20 days' smelting.

THE MINING NEWS

ALASKA

ALASKA TREADWELL—In December, 1912, 69,778 tons of ore crushed, yielded $191,393 in bullion and concentrate, or $2.77 per ton; the estimated net profit was $83,769.

ARIZONA

Maricopa County

PALO VERDE COPPER CO.—Recent developments are said to justify the working of a larger force of men.

RED DOG—At this mine in the Winnifred district north of Phoenix, operated by Dan Steele, an arrastre, operated by a gasoline engine, has been installed.

TIP-TOP—Five carloads of machinery are to be hauled from Phoenix to a new camp north of this old silver mine. A wagon road is now being built from Tip-Top to this camp.

LARS ANDERSON AND ASSOCIATES are working on a promising gold property west of Arlington. They report considerable activity in that district.

MAX-DELTA—This company at an early date will build a mill. Recent development work has proved a body of good milling ore. The property is seven miles south of Phoenix.

A DEPOSIT OF FIRE CLAY has been recently located by Joseph Porterio about two miles north of the Arizona canal. Fire tests prove the material to be excellent for the manufacture of firebrick.

BOWMAN & MURPHY, who recently bonded their cinnibar property in the Mazatzal mountains near the old Sunflower ranch, have just received their first payment; three more are to be made, and the final payment is to be made within nine months. A mining engineer has just left Phoenix to make another examination of the property.

VULTURE—Development work continues. Sinking and drifting have proved a large orebody. The mills, concentrators and cyanide plant are being operated at full capacity and it is reported that the capacity of the mill and cyanide plant will be increased at an early date. The precipitates which were formerly shipped to the smelter are now reduced to bullion at the mine.

Mohave County

ARABIAN—A fine shoot of ore has been opened up on this group in the Union Pass district by Eli Hilty.

CROWN CITY—A contract has been let for 100 ft. of shaft-sinking on this property which adjoins the Tom Reed Extension on the west.

BOUNDARY CONE—It is expected that work on this property will be resumed shortly. The large amount of water has delayed operations but more efficient pumping equipment is being provided. J. M. Vassar is general manager.

COPPER CANYON—Rich copper ore was recently struck on this property, owned by Connor, Lassell, Smith, and Sawyer. The property is in the Wallapai mountains about 25 miles east of Yucca. The surface ores carry considerable molybdenite. The copper ore was encountered in a crosscut from a tunnel driven on the vein about 85 ft. in.

AMERICAN METALS MINES CO.—This company has encountered ore in the shaft, which has been opened up to a width of 6 ft. without showing either wall. This ore contains much zinc besides gold, silver, lead and copper. A heavy flow of water has necessitated the discontinuance of shaft sinking until pumps can be installed.

YUCCA MINING CO.—The drift on the 700-ft. level has broken into rich ore, which is a heavy copper- and lead-sulphide, containing free gold. A carload is being hauled to Yucca for shipment to the smelter, this ore assaying about $1000 per ton in gold and silver. The lower-grade ore is being held on the dump for concentration. Improvements in the mine equipment are contemplated.

ARIZONA-SOUTHWESTERN—The No. 2 shaft on this property has reached a depth of more than 200 ft. No. 1 shaft is 300 ft. deep, the collar being about 100 ft. higher than that of No. 2 shaft. These two shafts have just been connected by a drift about 900 ft. long, which has opened up much ore. The new 150-ton steel and concrete concentrating plant is practically completed.

KINGMAN COPPER MINING & MILLING CO.—The drilling of the first hole for this property at Mineral Park is in progress and a depth of 160 ft. has been reached. Some sulphides have been encountered although mainly pyrite. W. W. Gates and Walter Brown have a contract for 5000 ft. of drilling, the maximum depth of the holes to be determined by the company and not to be over 500 ft. It is expected that another drilling rig will soon be on the ground.

CALIFORNA

Amador County

HARDENBERG—It is expected the new 20-stamp mill will be completed and the stamps dropping about the middle of February. H. S. Kelsey, of Jackson, is superintendent.

CARRARA—This marble deposit, two miles north of Pine Grove, is being examined, and is reported to have been bonded to W. F. Keeney, of San Francisco. The nearest railroad station is at Martell, 10 miles, which is said not to be a prohibitive distance.

KEYSTONE—The state supreme court has dismissed the appeal of Murphy and Ross, and confirmed the lower court of Amador County, declaring the Keystone company to be the owner of the mining properties, which are being extensively developed. The property is at Amador City. C. R. Downs is manager.

SOUTH JACKSON—This mine, which has been undergoing development for the last year, has been sold by George W. Brown to Adam Huberty, and by Huberty transferred to the South Jackson Mining Co. The price was $25,000. The sale resulted from the disclosing of a 3-ft. vein of free-milling and sulphide ore at the 500-ft. level in the vertical shaft. The shaft was being deepened while the drift was driven. The mine is operated by electricity, and is about one mile south of Jackson.

MOUNTAIN KING—The large amount of gold taken from the surface working of this and the Mountain Queen claim adjoining, both owned by W. B. Pitts, in Pine Grove district, has attracted attention to the fact that the Mountain Queen has not been definitely segregated from the homestead claim of George Preston. Both claims, however, were located prior to the homestead proof. It is possible that the dispute will be settled satisfactorily, and that the present owner of the mining claims will be permitted to proceed with the development of the property.

Butte County

UNION BAR—Favorable prospects are reported at this old camp, which in the early days was a large producer of drift gold. The situation is in the eastern part of the county near Bidwell. Organ Bros. are doing the drifting.

EL ORO—This dredging company at Oroville is reported to be preparing to redredge about 200 acres of its ground at greater depth. It is believed that a large proportion of the Oroville field may be redredged at greater depth and at a profit approximately equal to that obtained in the past. Charles Helman of Oroville is superintendent.

Kern County

KING SOLOMON—A vein of high-grade ore has been disclosed on the 85-ft. level of the Watchman and Tait lease.

CONSOLIDATED—It is expected that by Feb. 10 the new 5-stamp mill will be in operation.

BUTTE—Edward Shipsey, who successfully operated this mine under lease for the last two years, has secured a renewal for another two years. The Butte Lode Mining Co., of Los Angeles is the owner.

WILLIAM R.—This property at Randsburg has been leased to Edward Niehaus, Robert Taylor and Ambrose Hallford. The mine has produced a large amount of high-grade ore. There are three shafts ranging from 30 to 100 ft. in depth.

RANDSBURG WATER CO.—A new pump with capacity of 2000 gal. per hour has been installed at the Mountain wells pumping station. The Red Dog mill will now be able to resume full operation. A large tonnage of ore has accumulated during the time the pump installation was in progress.

AJAX—The raise at the end of the 185-ft. tunnel has been connected with the shaft. A drift on the vein east and west has been started and a winze will be sunk in the east drift. Six tons of high-grade ore have been sacked for shipment. Hallford Bros., of Randsburg, are lessees; F. B. Halloway, of Colton, is owner.

YELLOW ASTER—The 5% dividend paid on Nov. 25, amounting to $50,000, brought the total dividends paid on this mine to $1,111,897. The total paid in 1912 was $120,000. The company owns 40 patented claims. The mines are equipped with two stamp mills dropping a total of 130 stamps. The Yellow Aster Mining and Milling Co. is the owner.

Madera County

JESSIE BELL—A carload of ore from this copper mine was shipped in January to the Selby smeltery. The ore is rich in copper, and it is reported that the value of the gold and silver contents equals the cost of mining, treatment and shipping. The mine had been idle for several years and was recently reopened under a 4-year lease by T. S. and Ray Daulton, of Madera.

Mono County

A RICH STRIKE is reported in the Masonic district which lies near the California-Nevada line not far from Bridgeport, Calif., and southeast of Carson City, Nevada.

Nevada County

UNION CONSTRUCTION CO.—Prospecting on Deer Creek with Keystone drills has been suspended. The installation of a dredge was not warranted. The prospecting was done by William Colley, who operated in Alaska last season.

MONTANA GOLD MINING CO.—A shoot of high-grade ore has been disclosed on the 400-ft. level. The mine is equipped with a 5-stamp mill. It is situated in Willow Valley.

LECOMPTON—A landslide starting below the Idaho ditch put out of commission the power plant of this mine in Willow Valley. Two miners narowly escaped. A new pipeline, replacing the old one recently destroyed by the breaking of the reservoir by the snow slide, had just been installed. H. S. Abbott is the superintendent.

Placer County

HERMAN—Money for the development of this mine at Westville has been obtained by a deed of trust through the Colonial Trust Co. of Pittsburgh. The amount is said to be $500,000 at 7%. The Pennsylvania Gold Mining Co., of Pittsburg is the owner.

ELDORADO & PLACER—This dredging company expects to have its dredge at Butcher Ranch, on middle fork of American River completed early in June. The dredge will operate along Poverty bar and Oregon bar, where the gravel is rich. This locality was one of the largest producers of placer gold in the pioneer days of gold mining in California. Alfred Tregidgo, of San Francisco, is manager.

Tuolumne County

BURNS RANCH MINES—This property near the Black Oak has been bonded to a syndicate of Philadelphia men. Preparatory work is in progress for the installation of electric power for development.

BLACK OAK—This property on which was installed an all-slimes cyanide plant and a remodeled stamp mill early in 1912 is proving to be one of the largest producers on the east belt of the Mother Lode region. The 20-stamp mill is crushing 85 tons per 24 hr. The ore is high grade. R. C. Knox of Tuolumne is the superintendent.

COLORADO

Boulder County

WOLF TONGUE MINING CO.—This company, operating in the Nederland district, has completed a deal for the purchase of the Beaver Creek tungsten properties, owned by Alphonse Ardourel and David H. Smith. It is understood that there was paid for the 70 patented claims and the mill about $60,000. The mines are said to have produced between $35,000 and $40,000 worth of ore. Manager Leach announces that development work on the properties will be begun at once under the direction of D. H. Smith.

Clear Creek County

STANLEY—In January the Fifth Level West heading was advanced 85 ft. to a total length of 1873 ft. from the main shaft. The advance is in pay ore; Harry J. Wolf is general manager.

IDAHO BRIDE—The leasing company recently shipped two cars of ore from development. A 4-ft. vein of good ore has been opened on the Seaton vein 500 ft. from the Newhouse tunnel. A drift is being driven from the bottom of the 100-ft. winze on the Bride vein in the Idaho tunnel on a 2-ft. vein of rich ore. J. J. Hoban, of Idaho Springs, is manager.

HOOSAC—The new 10-stamp mill is in operation. The stamps weigh 1050 lb. each and drop 90 times per min. The pulp passes over amalgamating plates to a classifier, and is then concentrated. No elevators are used; the ore moves entirely by gravity. Each piece of apparatus is operated by a separate motor. The mill was built by Peter McFarlane & Co., of Central City. A new Ingersoll-Rand 10-drill compressor has been installed at the mine. A new shaft house has been built over the Rising Sun shaft and a 35-hp. electric hoist has been installed. Work has been resumed in the shaft, which is now 200 ft. deep. There are seven motors at the plant, aggregating 175 hp. E. D. Quigley is manager.

Teller County—Cripple Creek

STRATTON'S INDEPENDENCE—Production for December is reported as being 2939 tons, averaging $11.28 per ton. Of low-grade mine ore and dump ore, there were milled 11,100 tons. The total net working profit was $11,608, less $855, a special development charge.

GOLD SOVEREIGN—At the annual meeting, the old board of directors was chosen, including G. F. Lamb, C. G. Jackson, H. L. Shepherd, Henry Sachs, J. M. Auer, O. H. Hinds and E. J. Boughton. The board elected the following as officers for the coming year: O. H. Hinds, president; C. G. Jackson, secretary; H. L. Shepherd, treasurer, and E. J. Boughton, general counsel. The sinking of the shaft has been undertaken and it is now 40 ft. down.

MARY McKINNEY—Good ore is being mined on the ninth and eighth levels of the main shaft, according to an official of that company. On the ninth level, which is 900 ft. deep, the ore has just been encountered after drifting a distance of 200 ft. west and north of the shaft. It was at this point that the orebody was expected. The present production by the company, all of which comes from the main shoot, amounts to a car a day, said to be worth about $35 a ton. The annual stockholders' meeting will be held at the office of the company in Colorado Springs on Feb. 10, at which time directors will be elected and the annual reports submitted to the shareholders. The dividends have amounted to the full amount of the profits made each quarter.

GEORGIA

Dahlonega County

INVESTIGATIONS OF AURIFEROUS SAPROLITE DEPOSITS are now being made in this district, with the view of resuming operations on a large scale. The greater part of the ore would be mined in open pits. The low-grade ore is reported amenable to amalgamation. Arthur J. Hoskins, of Denver, is successfully operating a small mill.

IDAHO

Bonner County

IDAHO-CONTINENTAL—Now that the road from Porthill, a distance of 21 miles, has been put in condition for travel, machinery for the new concentrating plant is being hauled in.

Shoshone County

HEAVY SNOWS are reported throughout the mountains, and danger from slides and floods is expected later.

LEAD CRYSTAL—A fine strike of high-grade steel galena was made recently.

HYPOTHEEK—Shipments are now being made from the 500-ft. level and development work commenced on the 700-ft. level.

TERRIBLE EDITH—This is the only mine in the Murray district operating at present, the rest having shut down on account of heavy snows.

TOMBSTONE—The property of the old Tombstone Mining Co. has been taken over by the Carbonate Center Mining Co., organized recently in Spokane. The new company plans to begin operations at once.

IDAHO CONTINENTAL—Machinery is now being assembled at this mine near Porthill for installing as soon as the concentrator building and power house is completed, according to A. I. Goodell, local representative of the International Smelting Co. The equipment includes crushers, Diester tables and three sets of rolls.

CARBONATE CENTER MINING CO.—This company is said to have been organized to take over the property of the Tombstone Mining Co., comprising nine claims near Mullan. Archie Gillis has been elected president and Thomas G. Kennedy, secretary. It is reported that F. M. Rothrock, Fred Kratzer, Mitch Grostein, D. P. Bagnell, Charles McKinnis and John Voss are also associated with the organization.

MICHIGAN

Copper

ALGOMAH—Shaft sinking has been resumed at this property.

MOHAWK—The structural steel for the rock-house at No. 6 shaft has been delivered and erection will be started, but it will be about midsummer before the surface equipment for the new shaft is ready to go into service.

AHMEEK—The structural steel for the new rock-house for the Nos. 3 and 4 shafts has been erected and is being sheathed. The work of erecting the hoisting engine is going forward without delay and the boiler house is about completed.

SOUTH LAKE—The formation cut in this company's shaft at a depth of about 210 ft. has been passed through and shows a width about 40 ft., well mineralized throughout, with the last 4 ft. of it exceptionally rich. This shaft will be put down to a depth of 500 ft. before lateral openings will be started.

HOUGHTON COPPER CO.—Drifting at the 820-ft. level on the main Superior lode continues opening ground of good character. This depth is reached through a winze, as the shaft is temporarily bottomed at a depth of 625 ft. About 1500 ft. of drifting has been done at the bottom of the shaft and throughout the entire distance good ground has been opened. The rock is being accumulated in a stockpile.

HANCOCK—The work preparatory to putting this property on a producting basis is going forward satisfactorily. The crosscut from the 29th level is in about 130 ft. and is being driven to cut the No. 4 lode. The crosscut at the 33rd level has been extended about 70 ft., while the stations at the 3650- and 3925-ft. levels have been established and the crosscuts to the lode will soon be started. This No. 4 formation was cut in the shaft at a depth of about 3100 ft. and was heavily mineralized. In driving a croscut to reach this formation nearer surface another copper bearing amygdaloid was cut, showing a large amount of copper with about 3 ft. of it heavily mineralized. Drifting on this formation has been underway for some time and in the south end, which is breasted about 225 ft. from the crosscut, the formation has widened out, the rich streak being about 4 ft. wide. At the 13th level the crosscut has come into this formation and it will be opened before proceeding with the crosscut to the No. 4 lode.

Iron

M. A. HANNA & CO.—This company, which has been diamond-drilling on Sec. 18, 47-45, Gogebic range, is preparing to sink an exploratory shaft. The iron formation at this place is a mile wide, contrary to the usual width of the Gogebic Range iron formation, which throughout its length of 50 miles, is about ¼ mile wide.

CLEVELAND-CLIFFS IRON CO.—This company, the dominant interest on the Marquette Range, is increasing operations and taking on men at nearly all its mines. At Ishpeming, the Lake and Cliff Shafts mines are now working double shifts, in contrast to conditions a year ago; at Negaunee, the Maas, recently reopened, and Negaunee mines, are increasing forces constantly.

ASHLAND—This mine, at Ironwood, Gogebic Range, recently abandoned by the Cleveland-Cliffs Iron Co., is being operated by the Hayes brothers, who are the fee owners. They are preparing to line No. 9 shaft, the main hoisting shaft, with steel sets, believing that enough ore can be found to warrant the expenditure. The shaft is 1500 ft. deep. The orebodies at this mine are generally believed to be exhausted, and the operations of the Hayes' will be watched with interest. The mine was said to be exhausted once before, in 1898, when the Rockefeller interests turned the property over to the fee owners, but since then 3,500,000 tons of ore have been taken out by the Cleveland-Cliffs Iron Co.

DAVIDSON—At this mine of the New York State Steel Co. at Iron River the new vertical shaft is down 500 ft. with the first level opened at a depth of 450 ft. A station was cut and a main tramming drift driven. Compressed air is furnished by an electrically driven compressor in the new engine house; the compressor is similar to nearly all the others recently installed in Michigan iron mines and to the one which has been in successful operation at the North Lake mine near Ishpeming for over a year; it is an Ingersoll-Rand P. E., 2-stage compressor of 2500 cu.ft. per min. capacity. It is direct connected to a 400-hp. Westinghouse motor operating on a 3-phase, 60-cycle, alternating current of 2200 volts furnished by the Peninsula Power Co. at a price

of one cent per kilowatt-hour. Regulation of compressed-air to meet the varying needs of supply is effected by the Ingersoll-Rand "clearance control" device, an essential part of the machine. Hoisting at the vertical shaft is at present being done by the two hoists in the engine house at the inclined shaft, several hundred yards to the north, through a cable line on idlers. Space, however, has been left in the new engine house at the vertical shaft for two hoists, which may be electrically operated. The inclined shaft, 200 ft. deep, has been producing the ore shipped for the two seasons during which this mine has been operated. Mining has been done on the 150-ft. level where the ore is extracted in 10-ft. "subs." Rudolf Ericson is superintendent.

MISSOURI

Joplin District

SILVER DICK—This old mine, in the Oronogo bottoms, north of Webb City, is again producing. The mine has been worked at a profit with ore at $25 per ton, but caving ground practically stopped production.

IN THE AURORA CAMP 29 shafts are being worked on the United Zinc land. The drainage campaign, started some time ago, has enabled operators to get into the shallow deposits; 1600 gal. of water per min. is being raised by a No. 6 Texas pump, and in addition other smaller pumping stations are in operation.

A NEW LEAD-MINING DISTRICT is being exploited, 15 miles southeast of Sadalia, Webb City and Joplin men being interested. A new mine, the Camilla, is being opened up and placed in readiness to operate a 200-ton concentrating plant. The ore is free galena in milling ground and extends from the surface to a depth of 100 feet.

VINEGAR HILL MINING CO.—This company, operating the Century mine at Carl Junction, has withdrawn from the field after having worked out the ore. The deposit was worked for over a year and the production was heavy. The ground is now leased to small operators, who will gouge out the small bunches of ore that remain in the drifts.

MINOR HEIR-VANTAGE CO.—This company has lately been organized, after a period of testing and prospecting to clean out the old caves and drifts. A steam shovel has been installed to take out the dirt from a depth of 110 ft. to the surface, and the mill has been enlarged to handle 500 tons per day. A substantial tramway extends from an automatic feed hopper to the center of the west cave, on which are operated seven automatic dump cars of 4000 lb. capacity each. The richness of the cleanup has caused a demand for subleases, and three tracts have been let out at 25% royalty. Of these, two have begun to produce ore.

MONTANA

ANACONDA COPPER MINING CO.—This company, will add to the equipment at Black Eagle, seven 25-ton and two 10-ton General Electric mine locomotives.

Butte District

BROADWAY—Work will be commenced upon the building of a mill at this property in a short time. Machinery and other material for the construction are arriving and it is expected that the plant will be in readiness to treat the ore from this property early in the coming season.

CORBIN COPPER CO.—This company which took a lease and bond on the Blowout copper property in the Rochester district, is preparing to begin operations. The shaft will be sunk to a considerable depth, and timbers and supplies for the work have been ordered. An assessment of $1 per share has been levied, 50c. payable Feb. 11, the balance Apr. 22.

UNITED COPPER CO.—J. S. Shepard, Jr., and J. A. Cudworth have been appointed receivers for this company, which action is regarded as a step toward friendly reorganization. The assets are in excess of liabilities, being $6,000,000 and $4,500,000, respectively, but cannot be realized upon to liquidate present matured debts. On Feb. 5, 500 shares of preferred stock were sold at $4 per share.

Deer Lodge County

TRILBY—This mine, which adjoins the Holdfast, is being operated steadily, and some good ore is being developed.

HOLDFAST—This mine is being operated under lease by Robert Lindberg, who is shipping about two carloads of ore weekly to the Washoe smeltery.

ORO FINO—This property, adjoining the Southern Cross mine, is under option, but it has been decided by the owners in case the option is not exercised, to sink the shaft an additional 200 ft. and develop extensively.

Fergus County

BARNES-KING—The first shipment of bullion was made on Jan. 30 from the mill treating the ore from the North Moccasin property, at Kendall, giving returns of about $32000. This was obtained from 4022 tons of ore mined and treated between Dec. 14 and Jan. 21; $5000 of the purchase price of $150,000 was paid at the time that the company took over this property, and an additional $13,000 will now be paid. At the Piegan-Gloster property, in the Marysville district, Lewis & Clark County, the Ophir tunnel is being steadily advanced on the vein, and some good ore is being developed.

NEVADA

Comstock Lode

CHOLLAR—At the Brunswick No. 1 shaft a streak of ore is being followed upward from the 2000-ft. level, by a raise, and ore saved from the opening averaged $28.50 per ton.

SIERRA NEVADA—All operations on the 2500-ft. level are held up temporarily, owing to the burning out of a motor on the electric hoist of the joint Union-Sierra Nevada winze. Repairs will require from two to three weeks for completion.

CONSOLIDATED VIRGINIA—Driving the northwest crosscut on the 1000-ft. level is proceeding at a record pace, 80 ft. per week being made in ground that requires close timbering. The work is being pushed in order to begin development work in the vein as soon as possible.

EAST COMSTOCK—The East Comstock Reduction Co., recently incorporated, announces that it has acquired the Fisher mill in the Sixmile cañon district, and plans to enlarge it to 50 tons capacity. The mill is intended primarily for treating Comstock-Phoenix ore, and the continuous cyanide process is to be installed. Work on the new plant will begin as soon as the weather conditions permit.

Clark County

ACCIDENT—Lessees on this property have 100 tons of 72% lead ore ready for shipment. A considerable tonnage has been developed.

COLUMBIA—The recent litigation which closed this property has been settled by arbitration, and shipments of copper carbonate ore will be resumed at once. B. T. Hickman is in charge.

MONTE CHRISTO—Shipments are going forward at the rate of 12 cars per month, the ore being a 40% zinc carbonate, free from lead. A shaft is being sunk, and for 40 ft. has been entirely in ore.

PRAIRIE FLOWER—In this property, which adjoins the Yellow Pine on the north, a body of mixed lead and zinc ore has been encountered at a depth of 350 ft. Preparations are now being made for shipments. George Meacham is in charge.

BULLION—Orders have been placed for a new gasoline hoist for this property, recently purchased by Yount and Fayle of Goodsprings. The new owners will also install an aërial tramway 2000 ft. long. While waiting for new equipment, only development work is being done, a force of men being engaged in sinking the main shaft, which follows a vein of lead carbonate ore, six feet in width. O. J. Fisk was recently appointed superintendent.

Esmeralda County

GOLDFIELD CONSOLIDATED—The estimate of the results of January operations is as follows: Tons milled, 27,265; recovery, $505,000; net profit, $300,000.

Nye County

Shipments in tons from Tonopah mines for the week ended Feb. 1 are as follows:

Tonopah Mining	3500	North Star	45
Tonopah Belmont	3385	Mispah Extension	....
Montana-Tonopah	1005	Jim Butler	450
Tonopah Extension	1085	Tonopah Merger	165
West End	1060		
Midway	45	Total	11,090
MacNamara	350	Estimated value	$231,635

White Pine County

NEVADA CONSOLIDATED—In the last quarter of 1912, the production was 8,986,905 lb. of copper compared with 18,405,467 lb. in the preceding quarter, the reduction being due chiefly to the strike of the miners in October; earnings were $42,540 short of dividend requirements.

NEW YORK

St. Lawrence County

A PYRITES MINE AT FOWLER is being operated by Homer L. Drake of Gouverneur. The property is north of Sylvia Lake, and in January 1000 tons of ore were shipped. At present 50 tons are being shipped daily, but as soon as men and teams can be procured the output will be raised to 100 tons per day. The pyrite is clean, requiring no concentration, and the run-of mine ore is used by wood-pulp manufacturers in the vicinity, their total consumption of pyrites being 150,000 tons per annum.

NEW MEXICO

Socorro County

PACIFIC MINE—This property of the Oaks Co. is under bond and lease to M. B. Parker and W. J. Fulkerson, of El Paso.

MOGOLLON MINES CO.—A new engine, compressor drills and other machinery have been ordered for this company, new owners of the Ernestine. It is intended to begin sinking the old shaft. E. A. Wayne is manager.

OREGON

Malheur County

BODFISH—Dr. S. D. Taylor, of Vale, who has recently taken over this property, wil start operations when the snow leaves the hills.

BLACK EAGLE—It is reported that this mine will be unwatered and started up as soon as pending litigation has been disposed of. It is not known at this time what faction will have charge of the mine.

PENNSYLVANIA

ALUMINUM CO. OF AMERICA—A contract has been awarded to the Stone & Webster Engineering Co., of Boston, for the erection of a new plant at Kensington, to cost $1,500,000.

UTAH

Juab County

UNITED TINTIC—A car of copper-silver ore from this property is on the local market.

MAY DAY—A dividend for the first quarter of the year of 3c. per share has been declared, payable Feb. 10.

VICTORIA—The compressor recently installed will make it possible to carry on further development on the lower levels. About five cars weekly are being shipped.

NORTH CLIFF—Work is being done at this property near Silver City. The 200 level is being driven for ore, which was opened on the level above about 100 ft. from the shaft.

EUREKA HILL—Ore was opened in the Clark-Christopherson lease a short time ago, and is exposed in the roof and floor of the drift making in a northerly direction toward unprospected ground. The ore in this part of the property runs well in silver.

LOWER MAMMOTH—During the last four months of the year, this company shipped about $8000 worth of ore. At the recent annual meeting it was shown that on Sept. 1, there was an overdraft of about $1500, but that the year ended with $1150 on hand.

BECK TUNNEL—Some silver-lead ore has been opened about 200 ft. north of the No. 1 shaft on the 300 level. This is thought to be an offshoot of the main orebody mined out a few years ago. Ore is also being followed to the east of the Humbug ore zone. Eight cars were shipped during the present month, and three cars are nearly ready for shipment.

COLORADO—A systematic cleanup of old workings is being made, with no large amount of ore in sight. Weekly shipments of one to two cars are being made, the ore coming from offshoots from the main orebody. In the western part of the property, the "American" tunnel is in several hundred feet, the objective point being a vein opened by the Utah Consolidated. Forty men are being employed.

CHIEF CONSOLIDATED—The shaft is being sunk to the 1800 level. The annual report is being prepared. This will show 31,000 tons to have been marketed, netting about $10 a ton. This company has entered into a vertical sideline agreement with the Gemini, which will allow the former to take up development on what is known as the "Townsite" section of its property. Drifting is being done to make connections between the two properties, there remaining about 700 ft. still to be driven.

BLACK JACK—Drifting to the north is being done on the 300-ft. level in promising ground. From the same level a drift has been driven into the Dragon Consolidated, where it has encountered copper ore. A raise is being driven in this ore. Connections have been made between the 300-ft. level of the Black Jack and the 600-ft. level of the Iron Blossom, which afford better ventilation for both properties, and will facilitate the development of the western part of the Iron Blossom ground.

SCRANTON—A bedded deposit of zinc ore has been followed 300 ft. below the Del Monte tunnel level by the Knapp incline. At this point the ore makes into a fissure having a nearly vertical dip. Winzes are being sunk. Most of the ore has been coming from above the Del Monte level, the last carload lot averaging 36% zinc. There has been some delay in production on account of the non-arrival of transformers for the new electrical equipment. Active prospecting has been carried on, and it is expected that the normal production of about 800 tons per month will be resumed in the near future.

WASHINGTON

Okanogan County

DIVIDEND-LAKEVIEW—This mine has been forced to suspend operations for the rest of the winter, on account of heavy snows.

Stevens County

ROYAL COPPER M. & M.—L. J. Winslow, president, has let a contract for crosscutting at this property.

LIBERTY COPPER—A 100-ton mill is being installed at this mine at Blue Creek.

BLACKHORSE—Preparations are being made for the production of tungsten ore in the spring from this group near Daisy.

JUNE-ECHO—Hoisting machinery is to be installed at this mine near Chewelah. The shaft is now being sunk to the 200-ft. level.

DEAD MEDICINE—The drift on the 300-ft. level, which has been following the ore for 200 ft., shows 6 ft. of good-grade ore in the face. The shipping ore, which assays $4, occurs in a 14-in. streak.

STANDARD-CHEWELAH—This company is installing a 75-hp. boiler, compressor and pumps. As soon as the compressor is ready, two shifts will be put at work crosscutting from the 200-ft. level of the shaft.

CANADA

British Columbia

MAY BLOSSOM MINE—A contract for 50 ft. of drifting has been let to A. Van Schoorl.

Ontario Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Jan. 31, were as follows:

Bailey	.....	Kerr Lake	.....
Beaver	.....	La Rose	32.00
Buffalo	.....	Lost and Found	.....
Casey Cobalt	.....	McKinley-Darragh	42.75
Chambers-Ferland	31.20	Nipissing	.....
City of Cobalt	.....	O'Brien	.....
Cobalt Lake	.....	Penn.-Canadian	.....
Cobalt Townsite	41.00	Provincial	.....
Colonial	.....	Right of Way	.....
Coniagas	.....	Seneca Superior	.....
Crown Reserve	.....	Silver Queen	.....
Dominion Reduction Co.	.....	Timiskaming	.....
Drummond	.....	Trethewey	.....
General Mines	.....	Wettlaufer	.....
Hargraves	.....		
Hudson Bay	.....	Total	146.95

MANN—High-grade ore has been encountered in the winze below the 110-ft. level of this Gowganda property.

NOVA SCOTIA—An attempt is being made to re-finance this property.

HUDSON BAY—Another 300% dividend has been declared. This makes a total of $1,730,753 on an issued capital of $7761.

POWERFUL—A 6-in. vein of high-grade ore, with wall rock on each side which will make good milling ore has been struck on the 150 ft. level.

CASEY-COBALT—The new shaft has been connected with the 250-ft. level and will in future be the main working shaft of the property. The mill is treating about 27 tons a day with good recovery.

McKINLEY-DARRAGH—Application will be made to the Ontario legislature for an act authorizing the directors to declare and pay dividends out of the Company's funds and also to re-pay on account of capital, such amounts as they may determine, notwithstanding that the value of the net assets may be less than the par value of the issued stock.

Ontario-Porcupine

PORCUPINE NORTHERN, CENTRAL AND SOUTHERN—At the annual meetings of these three companies, the report of the treasurer showed the necessity of raising money to complete the assessment work. These three companies were floated by J. Thomas Reinhardt.

CARTWRIGHT GOLD FIELDS—This company which is operating in the Painkiller Lake district has installed a plant including a 3-drill compressor, hoist and boiler and has shipped the first load of ore. Sinking is being done on a vein which though narrow on the surface has widened to three feet and continues to show improvement.

McENANEY—It is stated that the main vein, which gives high assays, has been cut on the 400-ft. level. Colonel Carson, president of the Crown Reserve, which owns the McEnaney, considers the latter property worth the nominal capital of the Crown Reserve, that is, $2,000,000. There is still $115,000 owing on the purchase price. The quantity of ore developed and indicated from the surface down to 40 ft. below the third level is officially estimated at 34,995 tons which should yield a profit of $650,000. The shaft will be continued down to the 500-ft. level.

MEXICO

Guerrero

CAMPO MORADO—These properties, owned by the Reforma Mining & Milling Co., of Mexico City, are under option to Camp Bird, Ltd., of London. The option price is not stated. About three years ago The Exploration Co. Ltd., of London took an option on these mines at 20,000,000 pesos, and after examination is said to have offered 13,000,000 pesos. The offer was refused.

HUITZCO—The old cinnabar properties at Huitzco are producing from 50 to 60 flasks of quicksilver monthly. The properties are owned by the Romero Rubio estate, and are being operated by C. W. Whittemore. Plans to form a company in England to take over the properties have not been carried out. The Huitzco mines were at one time among the heaviest producers of quicksilver in Mexico.

Hidalgo

A 50-TON PLANT is being built by the Ludlow Bros. and associates to treat the ores of their mines in the El Chico district. It will be ready for operation in March.

HIDALGO COPPER—This company is starting up a 25-ton lead furnace at its properties in the Zimapan district. A 25-ton copper furnace has been in operation for several years.

FLOJONALES—The Towne interests have stopped exploration and development work at the Flojonales copper property in the Zimapan district, and will now determine the treatment process for the ores; 1,000,000 tons is said to be proved.

CIA. METALURGICA DE ATOTONILCO—This company's Nepton tunnel, 2½ km. long, has cut the Arevalo vein at a depth of over 300 m., and drifting is in progress. The company is at work on a 100-ton mill to treat the ores. The Mancera interests control the enterprise.

Jalisco

AMPARO—An extra dividend of 1% will be paid Feb. 10 in addition to the regular quarterly dividend of 3%. The disbursement will be $80,000. The company is increasing its miling capacity by adding two Krupp tube mills, making a total of four.

MEXICO DEVELOPMENT CO.—This company, controlled in Peoria, Ill., is building a 30-mile wagon road from its mines in the Purification district to the Pacific port of Chamela. The mines are those formerly held by the Coast Range Mining Co. The ore contains gold, silver, copper, lead and zinc. Development is in progress.

MOLOLOA—High-grade ore shipped from development in December amounted to 36 tons, having a value of 5703 pesos. The Soledad mine of the Mololoa group sent 728 tons of milling ore to the El Favor plant, and other Mololoa mines 157 tons. The profit for the month was 5455 pesos. Extensive exploration and development work is in progress.

Mexico

MONTE CARLO—This property is believed to have the same vein system as the Chontalpan, and is owned by men interested in the latter company. It is 2 km. distant from the Chontalpan. Old workings on the property are being reopened.

Puebla

MEXICAN LIGHT & POWER—This Canadian concern, owning the hydro-electric installation at Necaxa and supplying power to the El Oro and Pachuca mining districts, as well as to Mexico City, reports gross earnings for 1912 of 8,918,790 pesos, an increase of 672,441 pesos compared with the 1911 earnings. The net earnings were 6,478,088 pesos, an increase of 884,905 pesos.

Vera Cruz

A MERGER IS ANNOUNCED of the South Penn Oil Co., and the Penn-Mex Oil Co. to develop the latter's holdings. The capital of both companies exceeds $10,000,000.

Zacatecas

EXAMINATIONS OF LA NORIA MINE in the Sombrerete district have been made for Esperanza, Ltd., and not for Camp Bird, as previously reported, although the two enterprises are now controlled by the same English group.

THE MARKET REPORT

METAL WORKING

The metal markets have been for the most part in a rather disturbed condition, and with a downward tendency. There has been an active speculation in tin, with some sharp turns, both upward and downward.

Exports of specie from New York for the week were: Gold, $5,497,886, principally to Paris and Argentina; silver, $1,282,911, chiefly to London. Imports were: Gold, $269,425; silver, $172,096, largely from Central and South America.

Gold production in the Transvaal in January is reported by cable at 789,290 oz., or $16,314,624. This is an increase of 12,884 oz. over December, 1912, and a gain of 52,230 oz. over January of last year.

MONTHLY INDEX NUMBERS

Month	1912	1913	Month	1912	1913	Month	1912	1913
Jan.	111	126	May	118	...	Sept.	127	...
Feb.	109	...	June	117	...	Oct.	133	...
March	111	...	July	114	...	Nov.	129	...
April	115	...	Aug.	120	...	Dec.	129	...

Average for year 1912, 119; year 1911, 112; year, 1910 115; year 1909, 115
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

Gold—The price on the open market in London remained unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. About £300,000 of the gold arriving was taken for India, nearly all the rest going to the Bank of England. In New York $1,500,000 gold was taken for shipment to Argentina.

Iridium—This metal continues exceedingly scarce with prices at a high level, $82@84 per oz. being asked for pure metal.

Platinum—The market continues firm and prices are well held. Dealers here ask $45@46 per oz. for refined platinum and $49@52 per oz. for hard metal, according to grade. The foreign market shows no change.

Silver—Disappointment in regard to the settlement of the Six Power Chinese loan is the occasion of the decline in the price of silver. No new features are at present in sight.

Exports of Silver from London to the East Jan. 1 to Jan. 30, reported by Messrs. Pixley & Abell:

	1912	1913	Changes	
India	£835,300	£997,000	I.	£161,700
China	250,000	10,000	D.	240,000
Total	£1,085,300	£1,007,000	D.	£78,300

Messrs. Samuel Montagu & Co. write from London, Jan. 30: "The most feasible solution of present conditions is that Indian operators have arrived at the conclusion that bull speculation in silver has now lost much of its raison d'etre. The substantial character of the purchases made by the Indian Government, and the comparative ease with which they have been executed with a minimum of disturbance to prices, necessarily convey an impression that the holding of silver on a large scale, or a fresh purchase for a rise, is a more speculative transaction than it was when silver was quoted at lower figures."

Copper, Tin, Lead and Zinc

Copper—The refusal of buyers to become interested led to further concessions being made on Feb. 7, and rather sharp ones. This had the desired effect, some round lots being taken by domestic consumers, while a little was sold to Europe. The bulk of this business, covering February, March and April delivery was done at less than 15½c. About this time and on Feb. 8, some sales of fairly large lots were made by dealers at 15⅛@15¼c. This very cheap copper was apparently cleaned up on Feb. 8. On the 10th and 11th some sales were made by first hands at about 15⅜c., there was more inquiry in the market and a better tone generally. The United Metals Selling Co. and the American Smelting & Refining Co. have held to their price of 16¼@16½c., but the market has fallen far below that and seems now to have reached a point where buyers regard the metal as being intrinsically cheap and are interested consequently. But few transactions in Lake copper are reported and quotations for that kind are largely nominal. At the close, lake copper is quoted at 15⅝@15⅞c.; electrolytic in cakes, wirebars or ingots, 15¼@15½c., while casting copper is quoted at 15.20@15.30c. as an average for the week.

The London market has been somewhat firmer, due to bear covering and some buying for the bull account. On Feb. 6, both spot and futures were £66 2s. 6d.; on Feb. 7, spot advanced 10s. and futures 12s. 6d.; on Feb. 10, spot advanced £1 and futures 17s. 6d. On Feb. 11, there was a slight reaction, spot closing at £66 5s. and three months at £66 7s. 6d. with a better tone to the market.

Base price of copper sheets is now 22@23c. per lb. Full extras are charged, and higher prices for small quantities.

Copper exports from New York for the week were 3264 long tons. Our special correspondent gives the exports from Baltimore at 851 tons for the week.

The first sale of Katanga copper this year was held recently at Antwerp, 350 tons being offered. The Compagnie

DAILY PRICES OF METALS

NEW YORK

Feb.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
6	4.8755	62½	15⅝ @15¾	15¼ @15⅜	48¾	4.30 @4.35	4.15 @4.20	6.27½ @6.40	6.12½ @6.25
7	4.8770	62⅝	15⅝ @15¾	15¼ @15⅜	49¼	4.30 @4.35	4.15 @4.20	6.27½ @6.40	6.12½ @6.25
8	4.8775	62¼	15½ @15⅝	15⅛ @15¼	49½	4.30 @4.35	4.15 @4.20	6.25 @6.35	6.10 @6.20
10	4.8765	61⅞	15⅜ @15½	15⅛ @15¼	49⅜	4.30 @4.35	4.15 @4.20	6.20 @6.30	6.05 @6.15
11	4.8730	61⅞	15⅜ @15½	15⅛ @15¼	49⅜	4.30 @4.35	4.15 @4.20	6.20 @6.30	6.05 @6.15
12	.....	.....	.....	.....	.....	.....	.....	.....	.....

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. belo w that of electrolytic. The quotations for lead represent wholesale transactionsin the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Silver quotations are in cents per troy ounce of fine silver.

LONDON

Feb.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
6	28⅜	66⅛	66⅛	73	219½	217½	16 11/16	26
7	28 11/16	66⅜	66⅜	74	223½	221½	16¾	26
8	28⅝	....	....	....	....	....	....	....
10	28 7/16	67⅛	66⅛	74	224½	222½	16¾	25¾
11	28 7/16	66⅛	66⅛	74	223½	221½	16¾	25¾
12	....	....	....	....	....	....	....	....

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

Commercial Belge took 100 tons, the Compagnie Coloniale Anversoise 229 tons and 21 tons went to small buyers. The average price realized was 183.50 fr. per metric ton, equal to 16.06c. per lb. Another consignment of 650 tons is on the way.

Tin—After declining further on Feb. 6, the London market developed a very strong tone on Feb. 7, which was maintained. Domestic buyers took advantage of last week's low prices to purchase freely, especially future delivery tin. Nearby metal in this market is again becoming scarce and selling at a small premium. The close abroad is steady at £223 10s. for spot and £221 10s. for three months. February tin in this market is about 49⅜ cents.

Tin exports from the Straits in January are reported at 6054 long tons.

At the Banka sale on Jan. 30 there were 2500 tons of tin sold, the average price being 137.25 fl. per pikul. This is equivalent to about 50c. per lb., c.i.f., New York.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	Oct.	Nov.	Dec.	Jan.
Alaska shipments	1,435,235	1,671,367	3,766,029	.....
Anaconda	25,250,000	24,250,000	23,400,000	20,900,000
Arizona, Ltd	3,200,000	3,000,000	3,100,000	3,100,000
Copper Queen	8,184,575	8,807,940	8,805,568	7,554,966
Calumet & Arizona	4,404,000	4,918,000	5,840,000	.....
Chino	3,638,500	3,911,169	3,368,850	2,903,030
Detroit	1,934,828	1,968,620	2,389,875	1,769,071
East Butte	1,398,177	1,245,504	1,314,021	.....
Mammoth	1,883,283	1,805,869	.....	.....
Giroux	*nil*	*nil*	625,000	.....
Mason Valley	1,563,700	1,500,000	.....	1,575,100
Nevada Con.	850,741	4,160,533	3,975,631	.....
Ohio	187,141	573,644	566,816	.....
Oold Dominion	2,523,000	2,758,000	2,727,000	.....
Ray	3,403,755	3,191,926	3,638,500	.....
Shannon	1,209,804	1,435,709	1,361,420	1,232,000
South Utah	*nil*	*nil*	*nil*	.....
United Verde*	2,750,000	2,900,000	.....	.....
Utah Copper Co	2,022,352	4,562,417	5,676,484	.....
Lake Superior*	21,500,000	20,400,000	18,300,000	17,500,000
Non-rep. mines*	8,250,000	8,250,000	.....	.....
Total production	95,588,091	97,310,698	.....	.....
Imports, bars, etc	28,205,270	22,797,099	.....	.....
Total blister	123,793,761	120,107,797	.....	.....
Imp. in ore and matte	11,224,879	8,149,728	.....	.....
Total American	135,018,640	128,248,525	.....	.....
Miami†	2,577,750	2,972,000	2,913,840	2,932,369
Brit. Col. Cos.:				
British Col. Copper	1,022,904	881,582	.....	.....
Granby	2,018,424	1,852,896	.....	1,792,245
Mexican Cos.:				
Boleo†	2,612,400	2,315,040	2,480,240	.....
Cananea	4,428,000	5,064,000	4,592,000	.....
Moctezuma	3,045,667	2,112,377	2,793,781	2,913,294
Other Foreign:				
Braden, Chile	1,148,000	1,028,000	910,000	1,484,000
Cape Cop., S. Africa	757,120	907,200	770,560	.....
Kyshtim, Russia	.....	.....	.....	.....
Spassky, Russia	974,000	974,400	.....	.....
Tilt Cove, Newfoundland	86,785	.....	.....	.....
Exports from				
Chile	8,512,000	4,816,000	7,392,000	.....
Australia	9,520,000	10,752,000	9,856,000	.....
Arrivals in Europe$	13,771,520	12,976,320	16,363,200	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

$ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

Month	United States: U.S.Refin'y Production	United States: Deliveries, Domestic	United States: Deliveries, for Export	Visible Stocks: United States	Visible Stocks: Europe	Visible Stocks: Total
I, 1912.	119,337,753	62,343,901	80,167,904	89,454,695	158,323,200	247,777,895
II.	116,035,809	56,228,368	63,148,096	66,280,643	154,851,200	221,131,843
III.	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV.	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186.757
V.	126,737,836	72,702,277	69,485,945	65,066,029	134,176,000	199,242,029
VI.	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII.	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII.	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX.	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X.	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI.	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII.	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II.	.....	.....	.....	123,198,332	77,504,000	200,702,332

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Receipts of tin at Pacific ports of the United States for the year ended Dec. 31, were 2027 long tons in 1911, and 1923 in 1912; decrease, 104 tons. Receipts were chiefly from Australia.

Lead—The market is quiet and unchanged at last prices, 4.15@4.20c. St. Louis and 4.30@4.35c. New York.

The London market is slightly firmer, Spanish lead being quoted £16 15s. and English lead 7s. 6d. higher.

The Balbach Smelting & Refining C. has begun the construction of a new lead refinery of about 50,000 tons annual capacity, which will take the place of the present plant. The new refinery is being built on the company's Newark Bay property, adjoining its copper works. It is thought that it will be completed about midsummer.

Spelter—The market is weak, with free offerings and a slight demand. Prices have suffered further, and at the close St. Louis is quoted 6.05@6.15c.; New York at 6.20@6.30 cents.

The London market is lower, good ordinaries being quoted £25 10s. and specials £26 7s. 6d. per ton.

Base price of zinc sheets is now $8.75 per 100 lb., f.o.b La Salle-Peru, Ill., less 8% discount.

New discoveries of natural gas in the Osage district, Oklahoma, are reported to have relieved greatly the situation of the smelters at Bartlesville, who are no longer apprehensive respecting gas supply for some time to come.

It is generally believed that the Butte & Superior company has about overcome its milling troubles and that consequently a much increased supply of zinc ore is shortly to be expected from Butte.

Other Metals

Aluminum—The market has been inclined to dullness, with a moderate business only. Prices remain about the same at 25¾@26c. per lb. for No. 1 ingots, New York. London quotations are £88@92 per long ton—equal to 19.12@20c. per lb.—according to quantity and terms.

Antimony—Business has been rather slow and prices a little easier. Cookson's is 9.35@9.60c. per lb., and Hallett's 9@9.25c.; while 8.25@8.50c. is asked for Hungarian, Chinese and other outside brands. These prices are below the actual cost of importation at the current foreign market; but there were heavy imports in the last quarter of 1913, which are now being worked off.

Quicksilver—The market has again been rather quiet, but steady, and prices are unchanged. New York quotation is $40 per flask of 75 lb., with 59c. per lb. asked for retail lots. San Francisco, $40 for domestic orders and $37.50 for export. London price is £7 15s. per flask, with £7 7s. 6d@£7 10s. quoted by jobbers.

IMPORTS AND EXPORTS OF METAL

Exports and imports of metals in the United States, 11 months ended Nov. 30, in the measures usual in the trade:

Metals:	Exports 1911	Exports 1912	Imports 1911	Imports 1912
Copper, long tons	322,765	327,328	138,748	189,385
Tin, long tons	980	557	43,564	47,867
Lead, short tons	96,377	60,653	83,736	81,208
Zinc, short tons	5,750	6,619	1,340	8,910
Zinc in ore, lb	19,439,648	13,516,634	34,733,694	37,105,228
Nickel, lb	22,780,453	23,848,873	26,716,643	37,277,632
Antimony, lb	160,344	50,584	9,860,037	15,932,324
Platinum, oz	95	.....	110,937	93,345
Aluminum, lb	3,360	211,036	.....	18,966,468
Ores, etc.:				
Zinc oxide, lb	26,459,582	31,085,506	.....	.....
Zinc dross, lb	8,385,103	406,918	.....	.....
Zinc dust, lb	.....	28,800	.....	1,971,152
Chrome ore, ton	5	.....	38,309	50,929

Copper, lead, nickel and antimony include the quantities of metal contained in ores, matte, bullion, etc. Quantity of antimony ore is not reported. The metal exports given include reëxports of foreign material.

Zinc and Lead Ore Markets

JOPLIN, MO.—Feb. 8

The high price of zinc sulphide ore is $51, the base per ton of 60% zinc ranging from $44 to $48. Calamine sold at $24@28 per ton of 40% zinc. A few choice lots of lead sold at $54, the majority of sales being at $53 per ton of 80% metal contents.

SHIPMENTS, WEEK ENDED FEB. 8

	Blende	Calamine	Lead Ore	Value
Totals for week	10,877,820	609,580	2,299,110	$325,211
Six weeks	67,949,470	3,191,830	11,294,930	$2,106,706

Blende value, the week, $256,613; six weeks, $1,759,641.
Calamine value, the week, $8535; six weeks, $50,852.
Lead value, the week, $60,063; six weeks, $296,213.

IRON TRADE REVIEW

NEW YORK—Feb. 11

Reports from the iron trade continue almost monotonous. Though mill activity is persistent, most mills are behind in their orders. January was an excellent month generally, owing to the mild and fine weather, but in February, there has been more delay and rather slower working at mills on account of cold.

Pig Iron Production—The reports of the blast furnaces, as collected and published in the "Iron Age," show that on Feb. 1 there were 298 coke and anthracite stacks in blast, having a total capacity of 91,300 tons of iron daily; an increase of 600 tons over Jan. 1. Making allowance for the charcoal furnaces, the approximate make of pig iron in the United States in January was 2,830,300 long tons. Of this total, 1,981,600 tons, or 70%, was made by the furnaces owned by the steel companies.

The United States Steel Corporation reports the total unfilled orders on the books Jan. 31 at 7,827,368 tons of all kinds of material. This is 104,796 tons less than on Dec. 31, and is the first decrease shown since March, 1912. As compared with Jan. 31, 1912, the increase is 2,447,647 tons.

The decrease in January of the Steel Corporation's unfilled orders, 104,796 tons, corresponds with conditions as they have been understood in the finished-steel market since the beginning of the year. There was a slowing down in the general run of new bookings before the holidays, but a considerable tonnage of regular business came up for adjustment before the close of the year, which prevented December from showing a loss. Further losses this month and next are to be expected, and unless they are quite large they will not indicate that the market is on an unsatisfactory basis. In April and May the real test of the market will come. Meanwhile the mills are simply engaged in working off some of the enormous tonnage they have on books.

PITTSBURGH—Feb. 10

Specifications for steel products have been good, though perhaps not altogether as good as early in January. Car orders keep up well, and there is also much structural work. The weak feature of the market undoubtedly is the position of the cruder materials, coke, scrap and pig iron. Prompt furnace coke has declined fully $1.50 in less than 30 days, to $2.50, while scrap has continued the decline which began about the close of October. Pig iron has declined only slightly, but enough to show the direction of the trend.

Pig Iron—The market has been extremely quiet. Bessemer is unchanged, but the market is practically nominal. In basic no sales are reported at cut prices, but it is held in some quarters that $16.25, Valley, or a 25c. cut, is possible. Foundry iron, which was entirely too high at $17.50, Valley, in proportion to basic and bessemer, can safely be quoted at 25c. decline, although no important transactions have occurred. We quote: Bessemer, $17.25; basic, $16.50; No. 2 foundry, $17.25; forge, $16.75; malleable, $17@17.25, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market for prompt is rather uncertain, there being occasional efforts to dispose of small lots, which sometimes result in concessions as the market has little absorbing power. Contract material is very quiet. We quote both prompt and contract at $65, Baltimore.

Steel—Transactions in billets and sheet bars are far between, and there is really no regular market. Consumers are showing increased interest in second quarter, but mills thus far refuse to name prices. They are making a great effort to get in better position as to deliveries of finished steel, and as soon as they have achieved this position, which may be shortly, offerings of billets and sheet bars are likely to be plentiful enough to break the market, if the prices recently paid on small prompt lots can really be regarded as making the market. We quote billets at $29 and sheet bars at $30, f.o.b. maker's mill, Pittsburgh or Youngstown, for both bessemer and openhearth, but it is questionable whether any steel can be had at these prices. Rods remain at $30, Pittsburgh.

Sheets—Premiums for sheets for early delivery have probably declined somewhat, but are still important. Some of the mills are selling quite freely for third quarter at regular figures. Production is only slightly curtailed by the shortage of steel. We quote regular prices at 1.75@1.80c. for blue annealed, 10 gage, 2.35@2.40c. for black, 28 gage, 3.50@3.55c. for galvanized, 28 gage, and 2.55c. and 3.55c. per lb. for painted and corrugated roofing respectively.

IRON ORE—Feb. 11

Deliveries of Cuban ore in the East are rather behindhand, owing to the difficulty of getting ocean tonnage. Sales of Lake ore have been almost completed for the season, though there is a little ore still available.

Prices continue as fixed for the season, the base being 55% iron and under 0.45 phosphorus for bessemer ores, and 51.5% iron for nonbessemers: Old Range bessemer, $4.40, and Mesabi bessemer, $4.15 per ton; Old Range nonbessemers, $3.60, and Mesabi nonbessemers, $3.40; all at Lake Erie ports.

Imports of manganese ore at Baltimore week ended Feb. 8 were 5550 tons from Brazil and 14,100 tons from India; 19,650 tons in all. Imports of ferromanganese were 2639 tons.

German Iron Ore Imports 11 months ended Nov. 30 were 11,207,262 metric tons; exports 2,081,054 tons. Manganese ore imports were 473,934 tons; exports 6569 tons.

COAL TRADE REVIEW

NEW YORK—Feb. 11

The movement of coal in the West has been somewhat delayed by cold and stormy weather. Otherwise there is very little change in the situation from last week's report. The Seaboard bituminous trade also shows very little change.

Anthracite trade has started up a little, the demand for domestic sizes being increased by cold weather. From now until April it is likely to be very much a weather market.

Anthracite Shipments in January are reported at 5,763,696 long tons in 1912, and 6,336,419 in 1913; an increase of 572,723 tons, or 9.9% this year.

Coal and coke tonnage of Pennsylvania lines east of Pitsburgh and Erie, year ended Dec. 31, short tons:

	1911	1912	Changes	
Anthracite	11,957,149	10,312,348	D	1,644,801
Bituminous	42,419,445	46,434,187	I.	4,014,742
Coke	10,639,107	13,371,345	I.	2,732,238
Total	65,015,701	70,117,880	I.	5,102,179

The increase in 1912 over 1911 was 7.8%. The decrease in anthracite was due to the suspension in April and May.

CHEMICALS

NEW YORK—Feb. 11

The general market continues in pretty good condition with rather heavy business forward.

Arsenic—There is nothing new and the market is simply a matter of delivery against contracts. Prices, in the absence of new sales, are nominally unchanged at $4.50@4.62½ per 100 lb., both spot and futures.

Nitrate of Soda—There is more business doing in this article. Buyers are rather slow to take material, but the spring fertilizer trade is making itself felt in the market. Quotations are 2.62½c. for spot, 2.60c. for March and April, 2.57½c. for May and June, and 2.55c. for July and later deliveries. Baltimore quotation for spot is 2.60c. per lb., with futures correspondingly lower than New York.

Copper Sulphate—A fair business is being done, but prices are a little lower at $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

PETROLEUM

The monthly statement of the "Oil City Derrick" shows new oil wells completed as follows: Pennsylvania grade, 453; Lima-Indiana, 58; Kentucky, 11; Illinois, 132; Kansas-Oklahoma, 675; Texas-Louisiana, 153. In all the divisions 1482 wells were completed with a new production of 56,075 bbl. As compared with the December report, there were 53 more wells completed and the new production was 8250 bbl. greater. The Mid-Continental fields are responsible for the greater portion of new completions. The increased output comes from the Gulf Coast region. New work at the close of the month showed very little change from the December figures, the difference being eight fewer rigs and 82 less drilling, a net decline of 90. Every district showed the effect of bad weather in lessening work.

Assessments

Company	Delinq	Sale	Amt
Advance, Ida	Mar. 15	Apr. 15	$0.003
Andes, Nev	Feb. 4	Feb. 25	0.03
Atlantic, Ida	Jan. 23	Feb. 24	0.00½
Belcher, Nev	Feb. 7	Feb. 28	0.10
Coeur d'Alene Vulcan, Ida	Mar. 2	Mar. 22	0.005
Confidence, Nev	Feb. 7	Feb. 26	0.20
Consolidated Virginia, Nev.	Feb. 11	Mar. 4	0.15
Corbin Copper, Mont	.....	Apr. 22	0.50
Gould & Curry, Nev	Feb. 8	Feb. 28	0.03
Hider-Nevada Copper, Nev.	Feb. 26	.....	0.0½
High Grade, Mont	Jan. 18	Feb. 18	0.0½
Hypotheek, Ida	Feb. 21	Mar. 14	0.0½
Meicher, Utah	Feb. 11	Mar. 3	0.02
O.K. Silver M. & M. Co., Utah	Jan. 30	Feb. 20	0.0½
Pawhattan, Ida	Feb. 3	Mar. 3	0.00½
Pine Tree M. & M.	Feb. 17	Mar. 7	0.0½
Pioche Metals, Nev.	Feb. 10	Mar. 17	0.01
Rescue Eula, Nev	Feb. 5	Mar. 5	0.0½
Sierra Nevada, Nev.	Jan. 30	Feb. 20	0.10
Spider, Utah	Feb. 5	Feb. 25	0.0½
Tonopah North Star, Nev.	Jan. 13	Feb. 17	0.02
Umatilla Tonopah, Nev.	Jan. 20	Feb. 24	0.01
Utah, Nev	.....	.....	0.05
Western Star, Ida	Feb. 12	Mar. 8	0.002

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59 043	.....	24.081	27.190	.....
March	52.745	58.375	.....	24.324	26.875	.....
April	53.325	59.207	.....	24.595	27.284	.....
May	53.308	60.880	.....	24.583	28.038	.....
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	.....	14.329	.....	62 893	.....
March	14.698	.....	14.868	.....	65.884	.....
April	15 741	.....	15.930	.....	70.294	.....
May	16.031	.....	16.245	.....	72.352	.....
June	17 234	.....	17 443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78 670	.....
September	17 508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76 890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	12.962	.....	195.036	.....
March	12.577	.....	192.619	.....
April	43.923	.....	200.513	.....
May	16.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	.....	3.946	.....	15 738	.....
March	4.073	.....	4.046	.....	15.997	.....
April	4.200	.....	4.118	.....	16 331	.....
May	4.194	.....	4.072	.....	16 509	.....
June	4.392	.....	4.321	.....	17 588	.....
July	4.720	.....	4.603	.....	18 544	.....
August	4.569	.....	4.452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20.630	.....
November	4.615	.....	4.463	.....	18.193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	.....	6.349	.....	26 661	.....
March	6.626	.....	6.476	.....	26.048	.....
April	6.633	.....	6 483	.....	25.644	.....
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6 727	.....	25.763	.....
July	7.116	.....	6 966	.....	26 174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	.....	13.28	.....	14.01	.....
March	14.95	.....	13.66	.....	14.10	.....
April	15.13	.....	13.90	.....	14.15	.....
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14.90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17.09	.....	18.00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Feb. 10

Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con.	.01½
C. K. & N.	11½
Doctor Jack Pot	.06⅝
Elkton Con	.61½
El Paso	5.95
Findlay	.05
Gold Dollar	.14½
Gold Sovereign	.02½
Isabella	.13½
Jack Pot	.05½
Jennie Sample	.05½
Lexington	.008
Moon Anchor	.006
Old Gold	.02½
Mary McKinney	.63⅔
Pharmacist	.01½
Portland	.96
Vindicator	88
Work	‡.004

SALT LAKE Feb. 10

Name of Comp.	Bid.
Beck Tunnel	.10
Black Jack	.10
Cedar Talisman	.01
Colorado Mining	.15
Columbus Con	.10
Crown Point	.02
Daly-Judge	5.75
Grand Central	74
Iron Blossom	1.30
Little Bell	‡.10
Lower Mammoth	04
Mason Valley	8.25
May Day	.17½
Nevada Hills	1.25
New York	‡.005
Prince Con	77
Silver King Coal'n	2.90
Sioux Con	.04½
Uncle Sam	‡.11
Yankee	.12

TORONTO Feb. 7

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.10	Foley O'Brien	.17
Coniagas	8 75	Hollinger	14 50
T. & Hudson Bay	63.00	Imperial	.02½
Timiskaming	.37½	Jupiter	.40½
Wettlaufer-Lor	.17½	Pearl Lake	.48
Apex	.01⅜	Porcu. Gold	.23
Crown Chartered	.01	Preston E. D.	.04
Dobie	.20	Rea	.25
Dome	18.00	Swastika	.14½
Dome Exten	.12½	West Dome	.20

SAN FRANCISCO Feb. 10

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.03	Belmont	7.75
Belcher	.20	Jim Butler	73
Best & Belcher	.04	MacNamara	.21
Caledonia	.70	Midway	.32
Challenge Con	.04	Mont.-Tonopah	1.70
Chollar	.01	North Star	.20
Confidence	.37	West End Con	1.37½
Con. Virginia	.29	Atlanta	.17
Crown Point	.21	Booth	.02
Gould & Curry	03	C.O.D. Con	.06
Hale & Norcross	.08	Comb. Frac	.05
Mexican	.92	Jumbo Extension	.31
Occidental	.70	Pitts.-Silver Peak	.64
Ophir	.31	Silver Pick	.05
Overman	.23	St. Ives	.30
Potosi	.04	Tramp Con	.01
Savage	.05	Argonaut	‡1.75
Sierra Nevada	.19	Bunker Hill	‡4.50
Union Con	.16	Central Eureka	.19
Yellow Jacket	.21	So. Eureka	2.50

N. Y. EXCH. Feb. 10

Name of Comp.	Clg.
Amalgamated	72⅛
Am. Agri. Chem	51
Am.Sm.&Ref.,com	72⅝
Am. Sm. & Ref., pf.	106¾
Am. Sm. Sec., pf. B	85
Anaconda	37⅛
Batopilas Min	1⅛
BethlehemSteelpf	66
Chino	41⅜
Federal M. & S., pf.	39
Goldfield Con	2⅛
GreatNor.,ore,ctf.	38
Guggen. Exp	49
Homestake	115
Inspiration Con	16⅜
Miami Copper	23¼
Nat'nalLead,com.	51⅞
National Lead, pf.	106⅞
Nev. Consol	17⅜
Phelps Dodge	210
Pittsburg Coal, pf.	90½
Ray Con	19⅛
RepublicI&S,com.	27
Republic I & S, pf.	87½
SlossSheffi'd,com.	44
Sloss Sheffield, pf.	91¾
Tennessee Copper	34¾
Utah Copper	54
U. S. Steel, com	64⅛
U. S. Steel, pf.	108¾
Va.Car. Chem., pf.	110

N. Y. CURB Feb. 10

Name of Comp.	Clg.
Barnes King	.85
Beaver Con	.42
Braden Copper	9⅛
B. C. Copper	4⅛
Buffalo Mines	2¼
Caledonia	‡.40
Con. Ariz. Sm.	⅜
Davis-Daly	1⅞
Diam'field-Daisy	4⅛
Ely Con	13
Florence	42
Giroux	3⅛
Gold Hill Con	⅛
Greene Cananea	8¼
Greenwater	.06
Internat. S. & R.	‡124
Kerr Lake	3⅜
Keystone	‡2
La Rose	3⅛
McKinley-Dar-Sa	2
Min. Co. of A. new	3
Motherlode Gold	‡.60
Nev. Utah M. & S.	01
Nipissing Mines	9
Ohio Copper	⅞
Pacific Sm. & M.	⅛
Puebla S. & R.	2¾
South Live Oak	‡2
South Utah M. & S.	⅜
Standard Oil (Old)	1110
Stand'd Oil of N.J.	393
Stewart	1⅛
Tonopah	5⅛
Tonopah Ex	2
Tonopah Merger	.85
Tri-Bullion	½
Tularosa	⅞
Union Mines	‡⅛
United Cop., pfd.	10
Yukon Gold	3

LONDON Feb. 11

Name of Com.	Clg.
Camp Bird	£1 0s 3d
El Oro	0 18 0
Esperanza	1 11 3
Mexico Mines	6 12 6
Oriental Con.	1 12 0
Oroville	0 6 6
Santa Gert'dis	1 6 9
Tomboy	1 7 9

BOSTON EXCH. Feb. 10

Name of Comp.	Clg.
Adventure	4
Ahmeek	315
Algomah	2
Allouez	37½
Am. Zinc	32⅝
Ariz. Com., ctfs.	3⅜
Bonanza	.35
Boston & Corbin	6½
Butte & Balak	3
Calumet & Ariz	65
Calumet & Hecla	385
Centennial	16
Cliff	3
Copper Range	46½
Daly West	‡3½
East Butte	13⅛
Franklin	7⅛
Granby	68
Hancock	20½
Hedley Gold	29
Helvetia	⅜
Indiana	14⅛
Island Cr'k, com	55⅞
Island Cr'k, pfd.	86
Isle Royale	28½
Keweenaw	3
Lake	19½
La Salle	4⅜
Mass	4⅝
Michigan	1⅛
Mohawk	52¼
New Arcadian	2¼
New Idria Quick	6
North Butte	29⅝
North Lake	2
Ojibway	2⅛
Old Dominion	48⅝
Osceola	94¼
Quincy	72
Shannon	11¾
Shattuck-Ariz	25⅜
Superior	31
Superior & Bost	3¾
Tamarack	31
Trinity	4½
Tuolumne	3
U. S. Smelting	40
U. S. Smelt'g, pf.	48¾
Utah Apex	17⅜
Utah Con	10⅝
Victoria	1⅝
Winona	1
Wolverine	66
Wyandot	1¼

BOSTON CURB Feb. 10

Name of Comp.	Last
Alaska Gold M.	15⅝
Bingham Mines	4½
Boston Ely	⅜
Boswyocolo	‡.01
Butte Central	8½
Cactus	.07
Calaveras	3
Chief Cons	1¼
Corbin	.31
Cortez	.42
Crown Reserve	3½
Eagle & Blue Bell	1⅞
First Nat. Cop	2⅛
Majestic	46
Mexican Metals	1⅜
Moneta Porc	‡.03
Nevada-Douglas	2½
New Baltic	.99
Oneco	1½
Raven Copper	.22
Rhode Island Coal	.10
Smokey Dev	1⅝
S. W. Miami	3
South Lake	8½
Trethewey	.40
United Verde Ext.	.78

‡Last quotation.